

Dental professionals' knowledge and behavior towards utilization of gloves: a cross-sectional survey

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Keywords

Dental education • Gloves • Protective • Infection control • Infectious disease

Summary

Introduction. Dental practitioners are at risk of developing infections due to nature of their occupation which can be prevented by following proper infection control protocols, including proper use of gloves. Hence, the purpose of this study was to assess the perception and beliefs of dental healthcare providers towards usage of different type of gloves.

Methods. A self-administered questionnaire was distributed among a total of 241 participants out of which 198 participants (77 interns, 58 dental post-graduate students (PG) and 63 dental faculty members) returned completed questionnaire (response rate of 82.15%). The questionnaire comprised of questions on dental professionals' preferences for certain types of gloves and the reasons for these preferences, as well as determining their knowledge, beliefs and behavior concerning the use of dental gloves as a means of barrier protection. Data obtained was analyzed using chi-square test.

Results. Dental faculty members had a better knowledge regarding use of gloves as compared to dental PG students and interns. Most of the study participants preferred certain types of gloves for the purpose of better protection followed by comfort. Most of the participants believed that gloves provide full protection as long as there is no visible tear (interns 70.1%; PG students 50%; faculty members 60.3%). Most of the interns (42.9%) and PG students (41.4%) did not know about the fact that petroleum based products affect the integrity of the gloves. 2.6% interns, 29.3% PG students and 20.6% faculty members reported that they would not change gloves during an uninterrupted three-hour long procedure.

Conclusion. Most of the interns and PG students had poor knowledge regarding usage of gloves which calls for an action on the part of educators to educate and train dental professionals regarding proper infection control practices.

Introduction

Healthcare professionals, especially dentists, are at increased risk of developing infections because of the nature of their work. Dentists routinely come in contact with sharp instruments, some of which are operated at very high speeds and primarily work in the oral cavity which consists of contaminated oral fluids such as saliva and occasionally blood. Several studies have shown that dentists and dental assistants are at increased risk of infections with hepatitis B virus (HBV) and hepatitis C virus (HCV) [1]. The emergence of these infections along with others has led to development of Infection Control Guidelines by American Dental Association (ADA) [2]. These standard precautions emphasize on the use of personal protective barriers such as gloves, masks, eye-wares, head caps, etc. to prevent cross-contamination during examination or clinical procedures.

The primary purpose of wearing gloves during examination or clinical procedures is to prevent the risk of cross infection from healthcare professionals to patients and vice versa. Gloves are also used for reducing the contamination of the hands of healthcare professionals due to micro-organisms which can be transferred from one patient to another and to protect the users' hands from

blood and other body fluids. A number of studies in the past have demonstrated the efficacy of gloves in preventing contamination of healthcare professionals' hand and reducing the transmission of microbes [3-6].

Dentists usually prefer latex gloves; however, allergy to latex has given rise to other materials such as vinyl or nitrile gloves [7]. Each type of glove differs from others in some properties such as durability, barrier protection, elasticity and puncture during use and resistance to tear [7-14]. Quality of the gloves gets affected due to prolonged use and contact with materials like disinfectants, alcohol, etc. which results in increased permeability [15, 16]. These limitations have resulted in the use of double gloving technique. Double gloving technique resulted in reduced incidence of perforations in the inner gloves which in turn reduced hand contamination [17].

Though standard protocols are routinely followed by dentists to minimize cross-infections, there is dearth of literature showing understanding of the dentists in terms of using certain types of gloves and their perceptions towards using gloves as a mode of protection. Hence, the present study was undertaken with an aim to assess the perception of dental under-graduate students (Interns), dental post-graduate (PG) students and dental faculty

members (MDS staff) towards the effectiveness of gloves as a part of infection control in dentistry.

Material and methods

The present cross-sectional study was conducted on entire population of dental under-graduate students (Interns), dental post-graduate (PG) students and dental faculty members (MDS staff) of a dental institute in Maharashtra State, India. The study was conducted over a period of two months from November 2018 to December 2018. Ethical clearance for the study was obtained from the Institutional Ethical Committee (Ref No. 2800/ACPMMC/Dhule). A written informed consent was obtained from the participants after explaining them the purpose of the study.

QUESTIONNAIRE

Data was collected through self-administered anonymous questionnaire. The questionnaire was a modified version of previously used questionnaire by Kanjirath et al. [18]. Permission to use the questionnaire was obtained from the authors. Questionnaire was modified by adding a section on double gloving technique and effect of petroleum products on gloves and omitting questions based on use of gloves by the dental professionals during cold sore. Rest all the questions were used as per original questionnaire. The questionnaire was piloted on the experts (2 faculty members, 1 intern and 1 PG student) who gave their feedback concerning the face validity of the questionnaire and accordingly, the changes were made. The questionnaire was administered to a group of 15 subjects (5 interns, 5 PG students and 5 faculty members) twice at an interval of 10 days to check for test-retest reliability. The kappa coefficient value obtained was 0.76 which is good.

Each participant was given sufficient time (on an average 1 hour) to fill the questionnaire. Authors tried to limit the response bias by avoiding leading questions in the questionnaire, not recording any identifiable data and requesting participants to avoid any discussion with other participants while filling the questionnaire.

STATISTICAL ANALYSIS

Data was collected, compiled and analyzed using SPSS version 16. $P \leq 0.05$ was considered to be statistically significant. Descriptive statistics were employed to describe the responses of the participants. Comparisons were made for responses between Interns, PG students

and faculty members using chi square test and fisher exact test (where one of the cells has less than five observations).

Results

The questionnaire was distributed among a total of 241 participants out of which 198 participants (77 interns, 58 PG students and 63 faculty members) returned completed questionnaires. Response rate was 84.61% for interns, 72.5% for PG students and 90% for faculty members respectively. All the participants reported using disposable gloves.

Table I shows that the participant groups differed in the frequencies for the reasons for wearing certain type of gloves. Protection was the most frequently reported reason by all the participants (98.7% interns; 100% respectively PG students and faculty members; $p = 0.454$). Allergy to latex gloves were least reported factors for preferring certain types of gloves (15.6% interns; 8.6% PG students and 6.3% faculty members; $p = 0.177$). Around 92.1% of the faculty members and 84.5% of the PG students reported using certain type of gloves for comfort; whereas only 58.4% of the interns preferred certain type of gloves for comfort. This overall difference in preference for certain type of gloves among three groups was significant ($p = 0.001$). Pairwise comparison of preference of gloves for comfort showed that difference between interns and PG students ($p = 0.001$) and difference between interns and faculty members was significant ($p = 0.001$).

Table II shows that most of the respondents knew which type of glove provides the best protection i.e. latex gloves (80.5% interns; 87.9% PG students and 77.8% faculty members). The overall difference in their responses were statistically significant ($p = 0.032$). Pairwise comparison of type of gloves showed that difference between interns and PG students ($p = 0.012$) and difference between PG students and faculty members was significant ($p = 0.024$). Table III shows that 24.7% interns, 48.3% PG students and 84.1% faculty members reported that gloves protect against most of the bacteria and viruses. 54.5% interns reported that gloves provide full protection which shows their lack of knowledge. Out of total faculty members, 7.9% faculty members had no idea about the level of protection offered by gloves. This overall difference was statistically significant ($p = 0.001$). Pairwise comparison of degree of protection showed that difference be-

Tab. I. Reasons for preferring certain types of gloves n (%).

Group	Comfort	Protection	Allergy to latex	Cost
Interns	45 (58.4)	76 (98.7)	12 (15.6)	12 (15.6)
PG students	49 (84.5)	58 (100)	5 (8.6)	11 (19)
Faculty members	58 (92.1)	63 (100)	4 (6.3)	12 (19)
P value	0.001*	0.454	0.177	0.827

Chi-square test; * indicates significant at $p \leq 0.05$; the percentages add up to more than 100% because the respondents could choose more than one reason.

Tab. II. Best protection is provided by n (%).

Group	Vinyl	Nitrile	Latex	Don't know	P value
Interns	2 (2.6)	10 (13)	62 (80.5)	3 (3.9)	0.032*
PG students	6 (10.3)	1 (1.7)	51 (87.9)	0 (0)	
Faculty members	3 (4.8)	6 (9.5)	49 (77.8)	5 (7.9)	

Fisher exact test; * indicates significant at $p \leq 0.05$.

tween interns and PG students ($p = 0.001$), difference between interns and faculty members ($p = 0.001$) and difference between PG students and faculty members was significant ($p = 0.001$). 71.4% interns, 63.8% PG students and 81% faculty members reported that gloves do not provide sufficient protection against HIV/Hepatitis B viruses. Almost all the respondents (95.9% total) agreed upon the effectiveness of double gloving technique in reducing transmission of infection. ($p = 0.122$) Large proportion of responders (70.1% interns; 50% PG students and 60.3% faculty members) believed that gloves provide adequate protection as long as there is no visible tear. Few of interns (14.3%) and PG students (22.4%) reported that gloves are unsafe after 30 minutes of usage. 14.3% of faculty members didn't know about the length of time that gloves provide adequate protection. These differences in responses were significant ($p = 0.038$). Pairwise comparison of period of protection showed that difference between interns and faculty members was significant ($p = 0.025$). Almost all the faculty members (90.5%) knew about the effect of petroleum products in quality of gloves as compared to 57.1% interns and 58.6% PG students ($p = 0.001$). Pairwise comparison of effect of petroleum products

showed that difference between interns and faculty members ($p = 0.001$) and difference between PG students and faculty members was significant ($p = 0.001$). Almost all the respondents reported using separate gloves for separate patients. However, 10.4% interns, 12.1% PG students and 3.2% faculty members reported use of same gloves for more than one patient. (Tab. IV). Most of the respondents from each group (64.9% interns; 36.2% PG students and 49.2% faculty members) reported changing the gloves after 1 hour of procedure for an uninterrupted three-hour procedure (Tab. IV). 29.3% of PG students and 20.6% faculty members reported continuous use of same gloves for uninterrupted 3-hour procedure which shows their lack of knowledge regarding durability of gloves. The overall difference in responses was statistically significant ($p = 0.001$). Pairwise comparison of change of gloves showed that difference between interns and faculty members ($p = 0.007$) and difference between PG students and interns was significant ($p = 0.001$). Also, when asked about the practice of contaminating gloves by touching non-sterile items, almost all the respondents denied of touching non-sterile items with gloved hands ($p = 0.895$) (Tab. IV).

Tab. III. Beliefs concerning the way gloves provide protection n (%).

Question	Interns	PG students	Faculty members	P value
What degree do gloves prohibit passage of bacteria and viruses through the glove material?				
Full prohibition	42 (54.5)	4 (6.9)	1 (1.6)	0.001*
Protection against most bacteria and viruses	19 (24.7)	28 (48.3)	53 (84.1)	
Prohibit bacteria, but not viruses	1 (1.3)	11 (19)	4 (6.3)	
Little to no protection	1(1.3)	8 (13.8)	0 (0.0)	
Don't know	14 (18.2)	7 (12.1)	5 (7.9)	
Are the gloves sufficient to provide effective protection against HIV/Hepatitis B patient?				
Yes	22 (28.6)	21 (36.2)	12 (19)	0.054
No	55 (71.4)	37 (63.8)	51 (81)	
Is double gloves technique effective in reducing transmission of infection?				
Yes	73 (94.8)	51 (87.9)	55 (87.3)	0.122
No	4 (5.2)	7 (12.1)	8 (12.7)	
How long do gloves provide adequate protection?				
No visible tear	54 (70.1)	29 (50)	38 (60.3)	0.038*
30 minutes	11 (14.3)	13 (22.4)	5 (7.9)	
1-2 hours	4 (5.2)	9 (15.5)	11 (17.5)	
More than 2 hours	3 (3.9)	1 (1.7)	0 (0)	
Don't know	5 (6.5)	6 (10.3)	9 (14.3)	
Do petroleum based products affect the integrity of the gloves?				
Yes	44 (57.1)	34 (58.6)	57 (90.5)	0.001*
No	33 (42.9)	24 (41.4)	6 (9.5)	

Chi-square test; Fisher exact test; * indicates significant at $p \leq 0.05$.

Tab. IV. Practices of professionals about using gloves n (%).

Question	Response	Interns	PG students	Faculty members	P value
Usage of same gloves for more than one patient	Yes	8 (10.4)	2 (3.5)	2 (3.2)	0.072
	No	69 (89.6)	56 (96.5)	61 (96.8)	
If you were involved in an uninterrupted three hour procedure, how often would you change gloves?	After 30 mins	15 (19.5)	16 (27.6)	11 (17.5)	0.001*
	After 1 hr	50 (64.9)	21 (36.2)	31 (49.2)	
	After 2 hrs	10 (13)	4 (6.9)	8 (12.7)	
	Never	2 (2.6)	17 (29.3)	13 (20.6)	
Do you touch non-sterile items with gloves?	Yes	5 (6.5)	3 (5.2)	3 (4.8)	0.895
	No	72 (93.5)	55 (94.8)	60 (95.2)	

Chi-square test; Fisher exact test; * indicates significant at $p \leq 0.05$.

Discussion

Dental health care professionals should not forget the risks associated with treating patients with infectious diseases. Dental professionals are at increased risk of developing infections because of exposure to pathogenic micro-organisms residing in oral cavity as well as in respiratory tract of the patients. These microbes can be transferred directly to dental professionals by direct contact with patient's blood, saliva or oral secretions or indirectly through sharp injuries or droplet infections. Hence, it is mandatory for dental healthcare professionals to be properly equipped with personal protective barriers while treating every patient. Wearing gloves, one of the recommended protective barrier, helps prevent contamination of the operator's hands due to blood or saliva and also helps in prevention of transmission of infection from operator's hand to the patient [3-6].

In the present study, all the participants reported using disposable gloves while doing surgical procedures. Almost all the participants reported using certain types of gloves for the protection which shows awareness regarding usage of personal protective barriers among them. However, a study conducted by Kanjirath et al. [18] showed that only 40.5% of the professionals, 21.2% of 3rd and 4th year dental students and 37.1% of the graduate students used certain types of gloves for protection purpose. The present study showed increasing number of participants using certain types of gloves for the purpose of comfort from interns (58.4%) to PG students (84.5%) and faculty members (92.1%). This might be due to the fact that as the students step into post-graduate world from internship, they need to perform more complex procedures. Performing complex procedures requires more fine motor skills which can be acquired only when operator has a better sense of judgment about the type of gloves which gives him/her best fit and allow them to perform dental surgical procedures better. Tight fitting gloves may cause irritation by rubbing against the skin [19] and loose fitting may not allow for the proper grip of the instrument.

Almost all the participants believed that latex gloves provide best protection as compared to other two types. 10.6% of the participants reported using non-latex gloves, owing to latex allergy and the rest of the participants (90.4%) preferred latex gloves for routine pro-

cedures and might have never used non-latex gloves. Hence, they might have believed that latex gloves provide best barrier protection. However, literature shows that latex and nitrile gloves provide best protection in terms of barrier performance as compared to vinyl gloves [8-14]. Contrasting responses were seen in the previous study done by Kanjirath et al. [18] where mixed responses were observed for the type of gloves providing better protection.

54.5% of interns believed that gloves provide full protection against the passage of bacteria or viruses as compared to 6.9% PG students and 1.6% staff members, which is similar to study by Kanjirath et al. [18] This shows that more experienced health professionals had better knowledge. Literature also shows that continuous use compromised the integrity of the gloves [9, 20]. Responses to a follow-up question about protection against HIV/Hepatitis B patient showed that, 81% of the staff members and 63.8% of PG students believed that gloves do not provide effective protection against HIV/Hepatitis B patients. However, only 28.6% of the interns believed that gloves provide effective protection against HIV/Hepatitis B patients which was in contrast to the response to previous question regarding passage of bacteria or viruses through gloves. Most of the participants knew that double gloving technique is effective in reducing transmission of infection. The respondents were also assessed for how long they believed that they were protected by gloves. Majority of the participants in each group believed that gloves can be worn for a procedure as long as they show no visible tear. However, 14.3% of faculty members and 10.3% PG students had no idea about how long gloves provide sufficient protection as compared to only 6.5% of interns which raises concerns over their understanding of infection control protocols.

Previous study done by Kanjirath et al. [18] reported more number of participants stating that they did not know about how long gloves provide sufficient protection as compared to the present study. Almost half of the interns and PG students did not know about the effect of petroleum based lubricants on the integrity of the gloves which shows their poor knowledge towards usage of gloves.

The participants were asked about their gloves' changing practices to assess their own behavior. Few of the

participants reported using same gloves for more than one patient which is a serious practice requiring urgent rectification. This supplements the wrong practice in ensuring protection against infections i.e. the protection of only the healthcare providers, but not the patients. Reason reported for using same gloves for more than one patient was excessive workload which did not allow for the sufficient time to change the gloves in between multiple patients. Participants were also asked about frequency of changing the gloves when involved in uninterrupted three-hour procedure. Majority of the participants in each group reported changing their gloves after 1 hr which was contradicting to the response about the question regarding duration for which gloves provide protection where only few participants believed that gloves provide sufficient protection for 1-2 hrs. 29.3% PG students and 20.6% faculty members never changed gloves during such uninterrupted procedures which might put them and their patients at an increased risk of acquiring infections.

The results of the present study suggest lack of understanding of basic infection control protocols among interns and to some extent PG students too. Faculty members had a good knowledge and showed acceptable practices regarding usage of the gloves. This clearly shows that perception regarding the usage of gloves improves with increase in clinical experience. Based on the literature available, healthcare providers should keep in mind following things while using gloves: 1) use of disposable gloves, 2) using gloves that fit best to your hands, 3) use of latex or non-latex gloves depending upon need, 4) use of double gloving technique since gloves do not provide complete protection against all bacteria and viruses, 5) change of gloves after every hour in case of an uninterrupted three-hour procedure, 6) avoiding application of petroleum based products to gloves, 7) avoiding use of same gloves for more than one patient.

LIMITATIONS

The results are only representative of the population from which they were sampled; therefore, it is not possible to generalize the results to external population.

Conclusions

The findings of the study suggest poor perception of interns and PG students towards the usage of gloves of different types. It is the responsibility of the educators to provide students with adequate knowledge and training regarding infection control protocols, which will subsequently lead to prevention of infectious diseases.

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Conflict of interest statement

The authors declare no conflict of interest.

Authors' contributions

AD developed the original idea. HJ and RN carried out the literature search. HJ, AD and RN collected the data. MK carried out the statistical analysis and drafted the manuscript.

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