# Occupational Bloodborne Exposure Incident Survey & Management of Exposure Incidents in a Dental Teaching Environment

**Nabila A. Sedky, Ph.d.**
Assist. Prof. of Community and Preventive Dentistry, Faculty of Dentistry, Qassim University. Saudi Arabia

**Abstract:**

**Objectives:**The purpose of this study was to investigate the prevalence of occupational exposure incidents among undergraduate dental students and the factors associated with it in the educational dental clinics at Pharos University in Alexandria – Egypt, and to measure the commitment with applying infection control policy in the form of compliance with post-exposure management protocol and reporting exposure incidents.

**Materials and Methods:** An anonymous self-administered questionnaire consisting of thirteen multiple-choice questions was distributed among 350 undergraduate dental students in mid-senior and senior levels during lectures at the end of the second semester of 2011, with a response rate of 90.00%.

**Results:** About 62.00% of the senior students reported that exposures occurred outside the patient's mouth. A high percentage of both the mid-senior and senior students (74.70% and 70.70%, respectively) reported that they were exposed to multiple sources of incidents. The vast majority of studied groups stated that they didn't follow Infection Control Protocol after Incident Exposure.

**Conclusion:** The findings of this study confirm that dental students experience exposure incidents but are not likely to report them, thus it is important that the principles of infection control training and reporting of all exposure incidents continue to be emphasized throughout undergraduate dental education.

**Key words:** exposure incident, bloodborne exposure, risk factors, infection control protocol

**Correspondence:**

**Nabila A. Sedky, Ph.d.**
Assist. Prof. of Community and Preventive Dentistry,
Faculty of Dentistry (Female Section)
Community & Preventive Dentistry Dept.,
Qassim University.Buraidah 0420 Saudi Arabia
Mobile Phone#: +966 53812 7210
Tel. Home # : +966 6326 0536
E-mail: dr.nabila.sedky@qudent.org
nasedky@yahoo.com

**Introduction:**

The main objective of an effective infection control program in a health care environment is to devise and implement policies and procedures that will protect both workers and patients against transmission of a variety of infectious diseases. Although the ultimate goal of such a program may be to create an environment of no risk, in reality, minimizing the risk to the extent possible is the practical goal. Dental schools are faced with an even greater challenge in developing their infection control programs.These teaching institutions have not only the responsibility of protecting the patients but must also provide reasonable safety measures for the students, who have not yet mastered the technical skills necessary for their professions yet are engaged in patient-related activities. Evidence suggests that dental students may be at increased risk of exposure to bloodborne infections.[1-3] Close observation of the students' infection control practices and studying the circumstances involved in their occupational blood/infectious body fluids exposures will lead to introduction of safer devices and work practices that will offer students the best possible protection.[4]

Dental procedures are performed in close contact between dentist and patient and require considerable skill in the use of sharp instruments, which creates a setting where provider and patient are vulnerable to accidents. Experience, dexterity, and skill contribute to reducing the risk of accidents resulting from unpredictable patient movements generated by physical or emotional discomfort during treatment. However, despite efforts to instill technical proficiency in undergraduate dental students by means of preclinical laboratory training before they begin to provide dental treatment for patients, students have variable levels of technical skill, and some are more prone to accidents than others.[5-9]

Injuries from occupational accidents are associated with agents of biological risk, as they are the gateway to serious and potentially lethal infectious diseases that can be spread by contact between people, such as hepatitis B (HBV), hepatitis C HCV), and immunodeficiency virus HIV. Studies have demonstrated that dental students are among the most vulnerable to bloodborne exposure.[10-12]

The area in which the dental professional works includes anatomically and functionally complex structures of difficult access and visualization. These structures have different forms and dimensions, are often positioned very close to one another, and are the gateway to other systems of the organism, as well as being rich in potentially pathogenic microorganisms.[13]

Biological risk depends upon factors such as the presence and volume of blood, pathogenicity of the infectious agent, clinical conditions of the patient-source, susceptibility of the exposed person, and adequate post-exposure follow-up procedures.[14, 15] It is recommended that exposure to blood and other potentially contaminated fluids be treated as a medical emergency.[11] In order to achieve greater effectiveness, interventions for the prevention of infections from HIV and HBV need to be initiated immediately following occurrence of the accident.[15]

Following a percutaneous exposure involving blood known to be infected by HBV and the presence of HBeAg, which has a high rate of viral replication and therefore a greater quantity of circulating virus, the risk of developing hepatitis B ranges from 22 to 31%. The risk for hepatitis C is approximately 1.8%, ranging from 0 to 7%. With AIDS, the risk is 0.3% in percutaneous injuries and less than 0.1% in mucous membrane injuries.[15, 16] Because most injuries in dentistry are caused by small-gauge needles or compact instruments, dental professionals are exposed to a smaller volume of blood and, therefore, a lower risk.[17] In spite of these data, a number of studies have found a high rate of underreporting of occupational accidents among undergraduate dental students.[2, 7, 8, 18] However, there is a lack of systematized data on occupational accidents involving biological material. Due to the underestimation of infection risk and the underreporting of exposure, there are no reliable estimates regarding contact with pathogenic bioagents. Such lack of knowledge on the extent of the problem hinders the implementation and evaluation of preventative measures.[13] According to Younai et al.,[4] the investigation and documentation of circumstances of occupational exposure are crucial elements in the determination of risk factors.

Furthermore,there is scant systematic information on occupational exposure to biological material among undergraduate dental students in Egypt. The magnitude of exposure is unknown, which compromises the implementation and evaluation of preventive measures. Research is needed to determine the extent of student exposure to blood and other biological material. The findings from this research can be used to assess and potentially revise current strategies for cross-infection control.

Thus, the aims of the present study were to investigate the prevalence of occupational exposure incidents among undergraduate dental students and the factors associated with it as well as to measure the commitment with applyinginfection control policy in educational dental clinics in the form of compliance with post-exposure management protocol and reporting exposure incidents.

**Materials and Methods**

This study was conducted with undergraduate dental students attending Faculty of Dentistry, Pharos University (PUA), which is a private University in Alexandria, Egypt. The Faculty has an infection control policy that was officially implemented in 2009. The undergraduate curriculum is five years (ten semesters) with the fourth and fifth years (mid-senior and senior) consisting of clinical training along with didactic courses. Research approval was obtained from the ethical committee and Dean of the faculty prior to initiating the study.

The target study population was comprised of 350 undergraduate students in the clinical component of the curriculum, which corresponds to the two final years of study (mid-senior and senior). Data were collected from students during lectures at the end of the second semester of 2011. All students present were asked to complete a self-administered, anonymous questionnaire consisting of thirteen multiple-choice questions.

The questionnaire used a simple tick-box format, with sections for demographic items (such as age, sex and year of study), place of exposure occurrence, number of exposure incidents in the previous academic year, source of incident, activity resulting in exposure incident and the type of dental procedure performed that resulting in exposure. Students were questioned on the post-exposure management including wound processing, post-exposure prophylaxis for HBV & HIV, as well as post-exposure assessment of HBV, HCV & HIV. Students were also asked about their HBV immunization status. Also they were inquired if they inform their supervisor/clinical instructor immediately following the exposure, and whether the supervisor/clinical instructor report the incident immediately to the Faculty Infection Committee. Finally, students were questioned if their supervisor/clinical instructor complete a "Clinical Incident Report".

The questionnaire, pre-tested on randomly selected 35 samples (10%) to ensure its practicability, validity, interpretation of responses, and reliability (Cronbach's alpha $\alpha$=0.921).

***Statistical Analysis***

Statistical analysis was conducted using the SPSS program (SPSS 15.0 for windows, SPSS Inc., Chicago, USA). All statistical analyses were carried out at a significance level less than 0.05 & 0.001. Results were analyzed and compared by means of cross-tabulation and statistical association tests. The chi-square test was used to test associations between the level of undergraduate study and the independent variables (method of exposure occurrence, number of exposure incidents in the previous academic year, source of exposure incident, activity resulting in exposure incident, type of dental procedure performed, wound management after exposure, post-exposure prophylaxis & assessment and vaccination status, and following infection control protocol after exposure). Finally, Pearson's correlation coefficient was used to investigate associations between variables.

**Results**

Among the 350 students surveyed, 315 completed their questionnaires, representing 90.0% response rate. Of the respondents, 50.2% were males & 49.8% were females. Moreover, 53.7% were mid-senior students & 46.3% were senior students. The mean age of respondents was 21.46 years (SD+0.93 years; range 20–24 years).

**Table (1)** reveals the percentage of method of exposure occurrence and percentage of the number of exposure incidents in the previous

academic year according to level of undergraduate study. It was found that the majority percentage of exposures occurred outside the patient's mouth and registered among the senior students (61.64%). A statistically significant difference was found between the method of exposure occurrence and the level of undergraduate study ($\chi 2$=80.790, P<0.001). For the number of exposure incidents in the previous academic year, senior students reported a relatively high percentage of exposure in the form of 2 exposures (31.51%) as well as more than 2 exposures (35.62%). Also, a statistically significant difference was found between number of exposure incidents in the previous academic year and students in the mid-senior and senior levels of education ($\chi 2$=74.337, P<0.001).

**Table (2)** portrays the percentage of source of exposure incidents according to level of undergraduate study. It was found that the largest percentage of injury recorded between students in mid-senior students through the use of restorative instruments in the form of burs (80.00%), a statistically significant difference was found between the mid-senior and senior dental students ($\chi 2$=19.815, P<0.001), followed by endodontic instruments in the form of explorer (33.57%) and file (32.14%) used by senior dental students. A statistically significant difference was found for the injury from the use of endodontic explorer between senior and mid-senior dental students ($\chi 2$=5.161, P<0.05). Moreover, a high percentage of both mid-senior and senior students (74.70% and 70.70%, respectively) reported that they were exposed to multiple sources of incidents.

Results of the present study illustrates that 68.42% of mid-senior students exposed to exposure incident during the activity of disassembling handpiece from dental unit before removing burs, followed by 56.84% having injury as a result of unexpected movement by the patient. A statistically significant difference was found between mid-senior and senior dental students for the disassembling of the handpiece from the dental unit before removing burs as well as unexpected movement by patient ($\chi 2$=48.747, P<0.001 and $\chi 2$=23.206, P<0.001, respectively). Furthermore, 57.86% of senior students exposed to exposure incident during the cleaning of instruments after procedures performed, with no statistically significant difference between them and mid-senior students. On the other hand, 70.50% and 65.70% of both mid-senior and senior dental students respectively stated that they had multiple activities that resulting in exposure incident, **table (3)**.

Restorative dentistry procedures scored the highest percentage of exposure incidents for both senior and mid-senior students (86.43% and 83.16%, respectively) with no statistical difference between the two studied groups. Moreover, more than half of the studied groups in both levels of undergraduate study registered that the exposure incident resulted from multiple dental procedures that had been performed, **table (4)**.

**Table (5)** shows procedure of wound management after exposure. Only 2.86% of senior students reported that they perform all the procedures needed for post-exposure management. On the other hand, 4.21% of mid-senior students didn't perform any procedures after exposure incident, with a statistically significant difference between the studied groups ($\chi 2$=5.997, P<0.05).

For post-exposure prophylaxis, the majority of the studied students reported that they didn't offer either hepatitis B immune-globulin (HBIG) for hepatitis B exposure or antiretroviral drugs for an HIV exposure, with the highest percentage among senior dental students (68.57% and 100.00%, respectively). A statistically significant difference was found between studied groups ($\chi 2$=3.985, P<0.05 and $\chi 2$=45.292, P<0.001, respectively). Concerning post-exposure assessment for the source patient and the injured student, the studied groups reported that neither them nor the source patients were tested for the presence of bloodborne viruses (HBV, HCV and HIV), with a statistically significant difference between both groups. Regarding the vaccination status of the dental healthcare students, the majority of them registered that they previously received full course of HBV vaccine, with a statistically significant difference between groups ($\chi 2$=8.179, P<0.001). Whereas the vast majority of the students stated that they didn't previously receive post-vaccination testing for HBV surface antibodies. A statistically significant

difference was reported between groups ($\chi 2=17.227$, $P<0.001$), **table (6)**.

With regard to whether students follow infection control protocol after incident exposure or not, the vast majority of both groups scored high percentage for not informing their supervisors/clinical instructors' immediately following exposure, also the supervisor/clinical instructor didn't report the incident immediately to the Faculty Infection Control Committee. Moreover, the supervisor/clinical instructor didn't complete a "Clinical Incident Report" following initial treatment of the exposure site, **table (7)**.

**Table (8)** represents Pearson's correlation coefficient between mid-senior and senior dental students according to different studied parameters. The results revealed strong correlation between level of undergraduate study and post-exposure prophylaxis for the exposed student as well as post- exposure assessment for testing the exposed student for HBV, HCV and HIV. On the other hand a negative correlation was found between the level of undergraduate study and post-exposure assessment for testing the source patient for the presence of bloodborne viruses. No correlation was found between level of undergraduate study and post-exposure management protocol in the form of reporting the incident to the supervisor, as well as the supervisor / clinical instructor reporting the incident immediately to the Faculty Infection Control Committee and completing a "Clinical Incident Report". Moreover, a strong correlation was reported between the place of student's hands when exposure occurred and post-exposure assessment of the source patient for HCV, also if the supervisor/clinical instructor was informed immediately following the exposure, if the supervisor/clinical instructor reported the incident immediately to the Faculty Infection Control Committee (ICC) and if the supervisor/clinical instructor complete a "Clinical Incident Report". Whereas a negative correlation was detected between post-exposure prophylaxis of the exposed student, and post-exposure assessment of the student for HBV, HCV and HIV.

**Discussion:**

Dental students like other healthcare workers face a recognized risk of occupational exposure to bloodborne viruses such as HBV, HCV, and HIV.[8, 19]

Although blood contacts with skin and mucous membranes may be reduced through use of traditional barriers, such as gloves which reduces the inoculum of blood when the needle or any other sharps pass through glove, these barriers are not effective in preventing injuries with sharp instruments. When a student is exposed to sharp injuries, the risk of transmitting various types of bloodborne pathogens from an infected patient is greatly increased.[20]

Injuries in a dental college come from many causes. Some are related, directly or indirectly, to patient treatment. Others occur during preclinical laboratory exercises or in a dental laboratory.[20]

The results of the current study revealed that a high percentage of students subjected to injury when their hands were outside the patient's mouth (61.64%). The high rate of sharp injuries among dental students should be of concern because such injuries can lead to serious consequences. These findings to somewhat agree with that of Cleveland JL et al.,[21] in their observational study of dental residents, where they found that the majority of needlestick injuries occurred extra-orally during removable prosthetic procedures. Moreover, in the present study, accidental exposure was more frequently reported by senior students. The results of Younai et al.[4] were in contrast to the present findings where they observed a considerably higher rate of injury for third-year students compared to fourth-year, suggesting an elevated risk in the third year due to inexperience in performing invasive procedures. The dissimilarity in findings may be due towhether senior students experience a greater number of occupational episodes of exposure as a consequence of many dealings with their patients or whether they are more prone to report the incidents (or both).

Considering the source of exposure incident among the studied groups, bur injuries were the most frequently reported exposure among both mid-senior (80.00%) and senior (51.43%) students, confirming the results of other studies of dental students[22] and dentists.[23, 24]

Although there are no reports linking virus transmission with bur injury, burs often become contaminated with blood and thus pose a potential risk for students. Results of the

present study are in accord with findings in Canada,[25] where bur injuries were the most frequently recorded exposures among dental students. Given that bur injuries most often occur extraorally,[23] in the present study 68.42% of mid-senior as well as 22.86% of the senior students registered that injuries involving burs occurred after their use during disassembling handpiece from dental unit before removing burs, thus re-evaluation of the student orientation and commitment towards work-practice controls may prove beneficial. In reviewing reports from various dental schools, the rate of injuries from burs are reported to be 8%, [1] 9,[4] and 17%,[5] which is less than the results of the present study.

For anesthetic needles, the results in this study indicated that 27.37% of mid-senior and 28.57% of senior students were subjected to occupational exposure through anesthetic needles. These findings are lower than that reported from various dental schools.[1, 4, 5, 26]

An unexpected finding in the present work was that a high rate of students revealed that they were facing multiple sources of exposure incident in the form of 2 exposures and more, 74.70% for mid-senior and 70.70% for senior students. The substantial number of students who reported multiple episodes of exposure in the present study indicates that dental students are at risk when they work in the clinical environment.[7, 27] Also it can be said that students with limited technical skill and/or limited emotional and managerial skills for dealing with patients may characterize a high-risk group for occupational exposure.[11] These findings approximates the figure reported by Helenaura et al.,[28] where they found that 73.9% of their students were subjected to multiple episodes of exposure.

Accidental exposure was more frequently re-ported by mid-senior students through unexpected movement by their patients (56.84%) and through reaching for instruments on tray (38.95%), and for senior students (57.86%) during cleaning instrument after procedure, as well as when debriding instrument during procedure (29.29%). Such results may be interpreted as a result of lack of student interest to ensuring their safety during patient treatment, as well as non-application of infection control rules when dealing with the instruments after their use and while processing them for disinfection and sterilization.

A surprising result of the present study was the low rate of exposure to blood in the procedure of recapping needles in the form of two- hand recapping of needles, recapping a needle by cooperative effort between two people as well as recapping a needle by using a hemostat, this may be due to compliance of the students to the recommendations of using the one hand scooping technique for recapping needles when it is necessary. These results are in contrast with that of Helenaura et al.,[28] and Ramos-Gomez et al.[5]

The most common departments in which dental students had the experience of occupational exposure incidents were Restorative Dentistry, Oral Medicine/Periodontics and Endodontics in decreasing order. The great number of accidents could be explained by the use of sharp instruments that are required in the form of burs, periodontal probes and scalers, as well as endodontic files and explorers, and due to the invasive nature of the procedures. Less than quarter of the studied groups reported that they exposed to accidental injuries in Oral Surgery department. These results differ from that of Hashemipour et al.,[29] in which they reported that Endodontics was the top department in which the students experience needlestick injuries, followed by Surgery then Periodontic departments. Moreover, more than half of the studied students recorded that they were exposed to injury in more than one department.

Regarding the wound management after exposure, only 2.86% of the senior students reported that they apply the correct and complete protocol of wound management after their injury, and 4.21% of the mid-senior students didn't apply any procedure concerning wound management after exposure. Moreover the rest of students partially applied the wound management protocol. Low compliance among students, especially in wound management, may be partly explained by the perception that they are insignificant and pose no risk to them and this may be due to dental students doing their own risk assessment.[20]

Investigating and documenting circumstances of exposure, initiating appropriate prophylactic measures, performing necessary post-

exposure serologic testing for both the source patient and the injured student, and providing medical follow-up for the dental students, all are critical elements in determining source patient risk factors. Although it is difficult to quantify the risk for seroconversion, the risk assessment process will allow quantitative determination of the severity of risk. The findings of this study have shown that among the studied students with a history of occupational exposure incident, the majority of them (mid-senior and senior) did not offer Hepatitis B immunoglobulin (HBIG) for hepatitis B exposure, whereas about two-thirds of the mid-senior students and all senior ones did not offer antiretroviral drugs for an HIV exposure. These results involved a strong correlation between the level of undergraduate study and post-exposure prophylaxis of the injured students, meaning that the majority of senior students didn't care to take the necessary precautions following accidental exposure. Furthermore, according to the current results, post-exposure assessment for both the source patient and the exposed student were not accurately applied in PUA educational clinics. This reflects the fact that students were not aware of the importance of post-exposure prophylaxis and assessment of the source patient and student.

The infection control policy of PUA includes vaccination of all students against HBV in the pre-clinical phase starting from the fall semester of the third year and to complete their doses before starting to treat patients in fourth year. About 80.00% of the mid-senior students and 92.00% of senior students had received the hepatitis B vaccine prior to starting patient treatment. Such results are less than that proved in a former study in which previous investigation of needlestick injuries among Australian medical and dental students showed their hepatitis B vaccination rates to be 98% and 95%, respectively.[30]

On the other hand, about 20.00% of mid-senior and 8.00% of senior students had not completed the vaccination process before starting their clinical training. This could be due to lack of strict monitoring of the vaccination status prior to commencing of the clinical work. This is a serious shortcoming and stresses the need for closer monitoring and enforcement of immunization protocol amongst dental students. Unvaccinated individuals may have a 6–30% risk of becoming infected with the virus following an injury.[31]

Current Centers for Disease Control & Prevention (CDC) guidelines call for post-vaccination testing for antibody to hepatitis B surface antigen (anti-HBs) response for health care workers who are at risk for injuries with sharp instruments or needlesticks.[32] Unfortunately, only 9.47% and 27.40% of the students (mid-senior and senior, respectively) follow CDC guidelines and perform post-vaccination testing for HBV surface antibodies. The increase of knowledge of antibody response of the health care worker as well as the infectious status of the source patient will aid in determining appropriate post-exposure prophylaxis for the injured subject.

Much concern has been expressed in the literature about the underreporting of injuries occurring in the dental teaching environment.[4, 11] It is discouraging that around 60.00% and 54.00% of mid-senior and senior students registered that they did not inform their supervisor / clinical instructor immediately following the exposure. The present results are similar to the findings of Jaber.[20]Furthermore, previous investigation of British medical students also showed that 75% did not report their needlestick injuries.[33] Non-reporting of exposure incidents is a contentious issue within the dental profession the most common reason for that was the student's lack of knowledge that all injuries had to be reported.

It is regrettable that the majority of the supervisors / clinical instructors didn't report the incident immediately to the Faculty Infection Control Committee, also following initial treatment of the exposure site; they didn't complete a "Clinical Incident Report" as directed in infection control policy and post-exposure management protocol in PUA College of Dentistry. The results revealed that there is no correlation was found between level of undergraduate study and post-exposure management protocol.

Judging from the low reported injury rate for faculty in the current and other studies,[2, 11, 27] there might also be some reluctance among faculty members to strictly comply with the written guidelines of CDC with regard to the reporting of injuries. In a previous study, only half of faculty who experienced occupational exposures reported a problem to someone in authority.[11] Smoot reported that "most

students indicate that they do not see routine precautions undertaken by staff and residents, and no requirement for the compliance is enforced."[34] The importance of properly reporting all occupational bloodborne exposures to the proper authorities must first be promoted throughout the faculty of each institution before it can be expected to be appreciated by the student body and staff.

Exposure incidents do in fact occur. They are not to be ignored but rather reported immediately, especially if there is a possibility of exposure to bloodborne pathogens. Time is certainly of the essence in such exposures, and it is necessary that appropriate counseling and post-exposure prophylaxis occur as soon as possible. The infection control policy and post-exposure management protocol, if reinforced in dental school, will have a greater chance of being followed once the individual graduated and moves into private practice.

**Conclusion:**

Based on the findings of this study, student healthcare workers are at risk of accidental occupational injuries during their clinical training.

In the current study, a high prevalence of exposure incidents among undergraduate dental students was caused outside the patient's mouth mostly through Restorative Instruments in the form of burs. This was happened during disassembling handpiece from the dental unit before removing burs. Lack of commitment by students to infection control policies in the clinics led to their exposure to injury, whether the injury was during cleaning instruments after completing the patient treatment, or when the student debride the instruments during the treatment procedure itself, or even when the student try to reach the instruments on the tray.

Furthermore, the results revealed that post-exposure management was completely inadequate especially the reporting of occupational exposures. The majority of the students failed to report the exposure incidents. As the policy of PUA college of Dentistry provides that the supervisor / clinical instructor must report the incident immediately to the Faculty Infection Control Committee, also they have to complete a "Clinical Incident Report", but unfortunately the results of the present study proved that the majority of supervisors / clinical instructors didn't follow those procedures. Moreover, most students reported that they did not perform post-exposure assessment for either the source patient or for themselves after the exposure to know the extent of viral infection. Also, the majority of them didn't offer neither hepatitis B immunoglobulin (HBIG) for hepatitis B exposure nor antiretroviral drugs for an HIV exposure.

However, post-exposure management protocols exist in all PUA educational clinics, but the implementation of the protocol appears to be suboptimal given the students' lack of awareness of these procedures. Access to such programs should be readily available and rapid so that the time between exposure and post-exposure prophylaxis is as short as possible.

The majority of the students didn't comply with CDC guidelines concerning post-vaccination testing for antibody to hepatitis B surface antigen (anti-HBs). On the other hand, still there are some students who didn't estimate the risks of the profession and the consequences of non-vaccination.

**Recommendations**

- As PUA is a recent University and consequently the College of Dentistry is new one, and as the college possesses infection control policy, so all faculty members, staff and students must committed to those policies and always have to be applied regularly and strictly in order to maintain the health of students as well as to protect them and to graduate distinct generation of dentists.
- The prevention of exposure incidents remains a key in minimizing the risk of transmission of bloodborne viral infections. To that end, there is a need to invest resources into educating students and focusing on the proper use of devices, recapping and changing the anesthetic needles, cleaning of instruments, and how to overcome the unexpected movement by the patient as these factors contributed to a significant proportion of injuries among dental students in this study. These measures, if reinforced in dental school, will have a greater chance of being followed once the undergraduate students

graduated and move into their private practices.

- The results of this study indicate that dental students in PUA have some knowledge of occupational exposure incidents; nevertheless they failed to recognize appropriate management and reporting of such injuries. Therefore, there may an indication for more training of the students especially in work practice controls. Such controls might include restricting manual cleaning of instruments and minimizing the potential uncontrolled movements of patients during treatment procedure. Also, there is a need for improvements in the clinical training, in particular more instructional time devoted to prevention and management of post-exposure incidents. Students should also be made aware of the current procedure and protocol and need support and counseling by their Infection Control Committee.Moreover, reporting of exposure incidents needs to be reinforced among dental students. Increased reporting rates may be achieved through enhanced education, particularly for younger students who may not yet be aware of official reporting processes or the consequences of contaminated sharp injuries when they enter university or a teaching hospital.
- It is the responsibility of academic institutions to assure and facilitate appropriate preclinical immunization and provide training in infection prevention and control procedures to protect patients, healthcare workers and careers of undergraduates, and to lay the foundation for patients' safety and safety of healthcare workers by promoting safer working practices in the educational health care setting.
- It has to be emphasized on supervisors to abide the application of infection control policy including post-exposure management protocol to prevent the spread of infection in the educational clinics and to ensure the commitment of the students to take the necessary steps after injury. It is important that such protocol and post-exposure incident services be introduced to students at the time of their orientation before they begin their clinic experiences.
- This research is a starting point for further researches using different study designs and based on a larger scale.

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**Table (1): Percentage of method of exposure occurrence & percentage of number of exposure incidents in the previous academic year according to level of undergraduate study (N=315)**

| Variable | | Level of Undergraduate Study | | $\chi^2$ (p) |
|---|---|---|---|---|
| | | Mid-Senior % | Senior % | |
| Exposure occurred when student's hand was | Inside patient' mouth | 12.43 | 16.44 | 80.790* (0.000) |
| | Outside patient's mouth | 21.89 | 61.64 | |
| | Inside & outside patient's mouth | 21.89 | 17.81 | |
| | No exposure | 43.79 | 4.11 | |
| Number of exposure incidents in the previous academic year | 0 Exposure | 59.76 | 13.01 | 74.337* (0.000) |
| | 1 Exposure | 10.65 | 19.86 | |
| | 2 Exposures | 18.93 | 35.62 | |
| | More than 2 Exposures | 10.65 | 31.51 | |

*P<0.001

**Table (2): Percentage of Source of Exposure Incident according to level of undergraduate study (N=235)**

| Variable | | Level of Undergraduate Study | | $\chi^2$ (p) |
|---|---|---|---|---|
| | | Mid-Senior % | Senior % | |
| Hollow Bore needles | Anesthetic | 27.37 | 28.57 | 0.040 (0.840) |
| | Irrigation | 4.21 | 31.43 | 25.796** (0.000) |
| Restorative Instruments | Burs | 80.00 | 51.43 | 19.815** (0.000) |
| | Matrix band | 0.00 | 5.00 | 4.896* (0.027) |
| Endodontic Instruments | File | 24.21 | 32.14 | 1.732 (0.188) |
| | Explorer | 20.00 | 33.57 | 5.161* (0.023) |
| | Spreader | 0.00 | 3.57 | 3.467 (0.063) |
| Periodontal Instruments | Scaler | 16.84 | 14.29 | 0.285 (0.593) |
| | Curette | 8.42 | 5.71 | 0.654 (0.419) |
| | Cavitron tip | 21.05 | 0.00 | 32.215** (0.000) |
| | Probe | 27.37 | 32.86 | 0.802 (0.370) |
| | Explorer | 4.21 | 8.57 | 1.696 (0.193) |
| | Knife | 0.00 | 6.43 | 6.350* (0.012) |
| Surgical Instruments | Scalpel | 4.21 | 3.57 | 0.063 (0.802) |
| | Suture needle | 0.00 | 10.71 | 10.873** (0.001) |
| Miscellaneous | Waxing instrument | 4.21 | 5.71 | 0.264 ( 0.607) |
| | Orthodontic wire | 4.21 | 16.43 | 8.308** (0.004) |
| | Utility knife | 0.00 | 1.43 | 1.369 (0.242) |
| Source of Incident | Multiple | 74.70 | 70.70 | 0.458 (0.499) |
| | Single | 25.30 | 29.30 | |

*P<0.05
**P<0.001

**Table (3): Percentage of Activity resulting in Exposure Incident (N=235)**

| Variable | | Level of Undergraduate Study | | $\chi^2$ (p) |
|---|---|---|---|---|
| | | Mid-Senior % | Senior % | |
| Two- hand recapping of needles | | 15.79 | 11.43 | 0.940 (0.332) |
| Recapping a needle by cooperative effort between two people | | 0.00 | 2.86 | 2.761 (0.097) |
| Recapping a needle by using a hemostat | | 4.21 | 0.00 | 5.997* (0.014) |
| Removing unsheathed needle from non-disposable aspirating syringe | | 0.00 | 14.29 | 14.834** (0.000) |
| Passing a syringe with an unsheathed needle | | 0.00 | 2.86 | 2.761 (0.097) |
| Unsheathed needle used for multiple injections | | 0.00 | 4.29 | 4.178* (0.041) |
| Before disposal, needles are bent or broken | | 11.58 | 15.71 | 0.802 (0.371) |
| Disassembling handpiece from dental unit before removing burs | | 68.42 | 22.86 | 48.474** (0.000) |
| Unexpected movement by patient | | 56.84 | 25.71 | 23.206** (0.000) |
| Reaching for instruments on tray | | 38.95 | 15.71 | 16.247** (0.000) |
| Transferring instrument between operator and assistant/nurse | | 4.21 | 13.57 | 5.617* (0.018) |
| Using fingers in tissue retraction during suturing & administration of anesthesia | | 8.42 | 15.00 | 2.264 (0.132) |
| Debriding (cleaning) instrument during procedure | | 7.37 | 29.29 | 16.727** (0.000) |
| Cleaning instrument after procedure | | 46.32 | 57.86 | 3.028 (0.082) |
| During disposal of sharp items | | 4.21 | 21.43 | 13.5598** (0.000) |
| Activity resulting in exposure incident | Multiple | 70.50 | 65.70 | 0.599 (0.439) |
| | Single | 29.50 | 34.30 | |

*P<0.05
**P<0.001

**Table (4): percentage of Type of Dental Procedure Performed (N=235)**

| Variable | | Level of Undergraduate Study | | $\chi^2$ (p) |
|---|---|---|---|---|
| | | Mid-Senior % | Senior % | |
| Restorative dentistry | | 83.16 | 86.43 | 0.478 (0.489) |
| Pediatric dentistry | | 0.00 | 26.43 | 29.799** (0.000) |
| Oral medicine/Periodontics | | 50.53 | 38.57 | 3.293 (0.070) |
| Orthodontics | | 11.58 | 11.43 | 0.001 (0.972) |
| Prosthodontics | | 12.63 | 10.00 | 0.398 (0.528) |
| Endodontics | | 28.42 | 41.43 | 4.148** (0.042) |
| Oral Surgery | | 21.05 | 22.86 | 0.107 (0.744) |
| Type of dental procedure performed | Multiple | 54.70 | 55.00 | 0.002 (0.968) |
| | Single | 45.30 | 45.00 | |

*P<0.05
**P<0.001

**Table (5): percentage of Wound Management after Exposure (N=235)**

| Variable | | Level of Undergraduate Study | | $\chi^2$ (p) |
|---|---|---|---|---|
| | | Mid-Senior % | Senior % | |
| Stop the procedure immediately & remove gloves | | 81.05 | 75.71 | 0.936 (0.333) |
| Initiate first aid, including cleaning the wound | | 25.26 | 52.14 | 16.870** (0.000) |
| Apply antiseptic or disinfectant | | 75.79 | 72.86 | 0.253 (0.615) |
| Squeeze the wound to make it bleed | | 65.26 | 72.86 | 1.584 (0.213) |
| If eyes are contaminated, irrigate & wash with clean water, saline, or sterile water | | 12.63 | 33.57 | 13.198** (0.000) |
| Seek post-exposure medical care | | 15.79 | 21.43 | 1.162 (0.281) |
| No procedure performed | | 4.21 | 0.00 | 5.997* (0.014) |
| All procedures performed | | 0.00 | 2.86 | 2.761 (0.097) |
| Wound Management after Exposure | Multiple or all procedures | 76.80 | 75.70 | 0.040 (0.842) |
| | Single or no procedure | 23.20 | 24.30 | |

*P<0.05
**P<0.001

**Table (6): percentage of Post-Exposure Prophylaxis & Assessment, and Vaccination Status**

| Variable | | | | Level of Undergraduate Study | | $\chi^2$ (P) |
|---|---|---|---|---|---|---|
| | | | | Mid-Senior % | Senior % | |
| Post-exposure prophylaxis (N=235) | Were you offered | Hepatitis B immunoglobulin (HBIG) for hepatitis B exposure? | Yes | 44.21 | 31.43 | 3.985* (0.046) |
| | | | No | 55.79 | 68.57 | |
| | | Antiretroviral drugs for an HIV exposure? | Yes | 33.68 | 0.00 | 54.592** (0.000) |
| | | | No | 66.32 | 100.00 | |
| Post-exposure assessment (N=235) | Was the source patient tested for the presence of | HBV | Yes | 0.00 | 8.57 | 8.581** (0.003) |
| | | | No | 100.00 | 91.43 | |
| | | HCV | Yes | 0.00 | 13.57 | 14.027** (0.000) |
| | | | No | 100.00 | 86.43 | |
| | | HIV | Yes | 0.00 | 5.71 | 5.620* (0.018) |
| | | | No | 100.00 | 94.29 | |
| | Were you tested for the presence of | HBV | Yes | 41.05 | 10.00 | 31.244** (0.000) |
| | | | No | 58.95 | 90.00 | |
| | | HCV | Yes | 26.32 | 4.29 | 23.986** (0.000) |
| | | | No | 73.68 | 95.71 | |
| | | HIV | Yes | 22.11 | 0.00 | 33.984** (0.000) |
| | | | No | 77.89 | 100.00 | |
| Vaccination Status (N=315) | Had you previously receive | at least 1 dose of HBV vaccine? | Yes | 95.86 | 91.10 | 2.987 (0.084) |
| | | | No | 4.14 | 8.90 | |
| | | full course of HBV vaccine? | Yes | 80.47 | 91.78 | 8.179** (0.004) |
| | | | No | 19.53 | 8.22 | |
| | | post-vaccination testing for HBV surface antibodies? | Yes | 9.47 | 27.40 | 17.227** (0.000) |
| | | | No | 90.53 | 72.60 | |

*P<0.05
**P<0.001

**Table (7): percentage of following Infection Control Protocol after Incident Exposure (N=235)**

| Variable | | Level of Undergraduate Study | | $\chi^2$ (P) |
|---|---|---|---|---|
| | | Mid-Senior % | Senior % | |
| Did you inform your supervisor / clinical instructor immediately following the exposure? | Yes | 40.00 | 46.43 | 0.950 (0.330) |
| | No | 60.00 | 53.57 | |
| Did your supervisor / clinical instructor report the incident immediately to the Faculty Infection Control Committee? | Yes | 14.74 | 12.14 | 0.333 (0.564) |
| | No | 85.26 | 87.86 | |
| Following initial treatment of the exposure site, did your supervisor / clinical instructor complete a “Clinical Incident Report”? | Yes | 6.32 | 12.14 | 2.176 (0.140) |
| | No | 93.68 | 87.86 | |

**Table (8): Pearson Correlation Coefficient in study groups according to different studied parameters (N=235)**

| | | Level of Under-graduate Study | Place of student's hand when Exposure occurred | Hepatitis B immune-globulin | Anti retroviral drugs for HIV | Post Exposure assessment Source patient tested for | | | Post Exposure assessment Student tested for | | | Supervisor informed immediately following exposure? | Supervisor report the incident to Faculty ICC? | Supervisor complete a "Clinical Incident Report"? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | HBV | HCV | HIV | HBV | HCV | HIV | | | |
| Level of Undergraduate Study | **r** | | | | | | | | | | | | | |
| | **P** | | | | | | | | | | | | | |
| Place of student's hand when Exposure occurred | **r** | -0.112 | | | | | | | | | | | | |
| | **P** | 0.086 | | | | | | | | | | | | |
| Hepatitis B immune-globulin | **r** | 0.130* | -0.189** | | | | | | | | | | | |
| | **P** | 0.046 | 0.004 | | | | | | | | | | | |
| Antiretroviral drugs for HIV | **r** | 0.482** | -0.342** | 0.523** | | | | | | | | | | |
| | **P** | 0.000 | 0.000 | 0.000 | | | | | | | | | | |
| Post Expo. Assessment Source patient HBV | **r** | -0.191** | -0.088 | -0.096 | -0.092 | | | | | | | | | |
| | **P** | 0.003 | 0.177 | 0.142 | 0.159 | | | | | | | | | |
| Post Expo. Assessment .Source patient HCV | **r** | -0.244** | 0.196** | -0.031 | -0.118 | 0.498** | | | | | | | | |
| | **P** | 0.000 | 0.003 | 0.638 | 0.072 | 0.000 | | | | | | | | |
| Post Expo. Assessment Source patient HIV | **r** | -0.155* | 0.021 | -0.045 | -0.075 | 0.809** | 0.633** | | | | | | | |
| | **P** | 0.018 | 0.745 | 0.491 | 0.255 | 0.000 | 0.000 | | | | | | | |
| Post Expo. Assessment Student HBV | **r** | 0.365** | -0.135* | 0.372** | 0.528** | -0.033 | -0.085 | -0.101 | | | | | | |
| | **P** | 0.000 | 0.038 | 0.000 | 0.000 | 0.618 | 0.192 | 0.121 | | | | | | |
| Post Expo. Assessment Student HCV | **r** | 0.319** | -0.348** | 0.356** | 0.762** | -0.090 | -0.023 | -0.073 | 0.662** | | | | | |
| | **P** | 0.000 | 0.000 | 0.000 | 0.000 | 0.167 | 0.722 | 0.264 | 0.000 | | | | | |
| Post Expo. Assessment Student HIV | **r** | 0.380** | -0.429** | 0.412** | 0.789** | -0.073 | -0.093 | -0.059 | 0.580** | 0.804** | | | | |
| | **P** | 0.000 | 0.000 | 0.000 | 0.000 | 0.267 | 0.156 | 0.369 | 0.000 | 0.000 | | | | |
| Supervisor informed immediately following exposure? | **r** | -0.064 | 0.151* | 0.041 | -0.251** | -0.049 | 0.147* | -0.071 | -0.066 | -0.142* | -0.277** | | | |
| | **P** | 0.332 | 0.020 | 0.531 | 0.000 | 0.454 | 0.024 | 0.277 | 0.312 | 0.030 | 0.000 | | | |
| Supervisor report the incident to Faculty ICC? | **r** | 0.038 | 0.287** | 0.069 | -0.008 | 0.024 | 0.069 | -0.073 | 0.211** | -0.003 | -0.122 | 0.340** | | |
| | **P** | 0.566 | 0.000 | 0.290 | 0.902 | 0.716 | 0.293 | 0.264 | 0.001 | 0.960 | 0.062 | 0.000 | | |
| Supervisor complete a "Clinical Incident Report"? | **r** | -0.096 | 0.399** | 0.047 | -0.131 | 0.054 | 0.112 | -0.062 | 0.165* | -0.128* | -0.103 | 0.373** | 0.845** | |
| | **P** | 0.141 | 0.000 | 0.473 | 0.045 | 0.412 | 0.085 | 0.345 | 0.011 | 0.049 | 0.115 | 0.000 | 0.000 | |

*Correlation is significant at the 0.05 level (2-tailed).

**Correlation is significant at the 0.01 level (2-tailed).