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KNOWLEDGE, AWARENESS AND COMPLIANCE AMONG DENTAL PROFESSIONALS REGARDING PERCUTANEOUS EXPOSURE INCIDENTS AS OCCUPATIONAL HAZARD IN JIZAN, SAUDI ARABIA.

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ABSTRACT

Healthcare workers, including dental practitioners and dental students, are at risk of occupational exposure to blood-borne pathogens such as hepatitis B, C and HIV. The present study set out to determine the prevalence, knowledge, management and perceptions of percutaneous injuries among staff and students at a dental training institute in Jizan, Saudi Arabia with a view to identifying policies aimed at reducing the incidence. The prevalence of percutaneous injuries experienced by dental staff and students in 2017 was determined. The levels of knowledge and their management of percutaneous injuries were determined among current dental staff and students. Amongst the current staff and student cohort, 22% reported having sustained a percutaneous injury. Of these, 43% had experienced at least one, more than half (57%) had suffered more than one injury and almost a quarter (24%) had experienced three or more PEIs. More than a half of the injuries (57.9%) were due to mishaps with the dental syringe and needles. Injuries associated with the use of the dental elevator and Blade were also common (10.5% each). High risk activities have been identified, enabling recommendations on modifications of work practice to reduce the incidence of percutaneous injuries at the ODTC. Accidents are sometimes unavoidable but attending to a percutaneous injury as soon as it occurs, treating it as a medical emergency and following through with the management protocol are of utmost importance to prevent the transmission of blood-borne diseases.

KEYWORDS: Blood borne pathogens, Hepatitis (B, C), percutaneous injuries.

INTRODUCTION

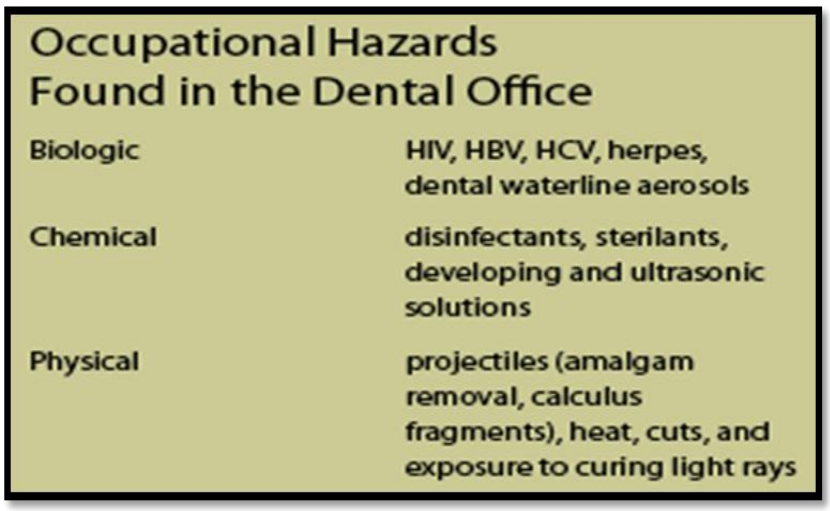
Healthcare workers (HCW) are on a daily basis at risk of exposure to blood-borne pathogens through percutaneous exposure incidents (PEI). "Percutaneous exposure incident" is a broad descriptive term that includes needle stick and injury with a sharp object, as well as cutaneous and mucosal exposures to blood, saliva, tissue and other bodily fluids that are potentially infectious. Nurses, physicians, surgeons, laboratory workers, dental and medical personnel, and students in clinical training are considered high risk categories.[1]

Oral health care workers are particularly vulnerable as the dental environment is unique when compared with other health care settings due to the oral cavity being a small operating field, the close contact that is required between dental personnel and the patient during procedures, the possibility of sudden movements of the patient, the use of sharp dental instruments and the likelihood of direct or indirect contact with traumatized tissues, saliva and blood, all on a daily basis. Furthermore, collisions with sharp objects can occur due to the close positioning of the instrument delivery system which houses the hand pieces, most probably fitted with pointed burs, and handily placed to effect injury when the operators themselves move without care.[3]

Most injuries occur during oral surgery procedures (35%), 19% during restorative work, 13% in hygiene procedures and 9% are associated with periodontal surgery. Research indicates that the majority occur as a result of an accident with the dental syringe during the administration of a local anesthetic.

The reported prevalence of percutaneous injuries among dental students ranges from 20%-80%. Students are at a higher risk due to their inexperience in handling clinical instruments and infection control procedures and by the pressure occasioned by the need to complete a set number of clinical case requirements to the satisfaction of the supervisor.[2]

Table 1: The different types of Occupational Hazards fount in the Dental office.



The history of occupational hazard awareness can be traced back to the 18th century when Bernadino Ramazzini, who is referred to as the **'Father of Occupational Medicine'**, recognized the role of occupation in the dynamics of health and diseases.[1] Occupational health hazards are not uncommon.[2, 3] Although modern dentistry has been cited as the least hazardous of the all the occupations[4], many risks still challenge the status of this occupation.

Studies have shown that dentists report more frequent and worse health problems than other high risk medical professionals.[5] Dental personnel are exposed to various occupational hazards like stress, allergic reactions, higher noise levels, percutaneous exposure incidents, radiation, musculoskeletal disorders, legal hazards etc. This is in accordance to other studies where occupational hazards such as interactions with patients, physical strain and financial pressure negatively related to psychological wellbeing of dental professionals.[6-10] A part from this, dental environment is also associated with a significant risk of exposure to various micro-organisms.

Infectious agents may be present in blood or saliva, as a consequence of bacteremia or viremia associated with systemic infections.

Dental patients may be exposed to variety of micro-organisms via blood or oral or respiratory secretions.[1] These micro-organisms may include cytomegalovirus, hepatitis B virus, hepatitis C virus, herpes simplex virus types 1 and 2, HIV, mycobacterium tuberculosis and other viruses and bacteria, especially those that infect the upper respiratory tract.[11] Microorganisms can pass into organism, through a cut on the skin of his/her hand while

performing a medical procedure, any dental procedure resulting in an accidental biting by the patient, or through a needle wound created while imparting anesthesia. An indirect infection occurs when an infectious agent is transmitted into organism through the so-called carrier. The following are the main sources of indirect infection: aerosols of saliva, gingival fluid, natural organic dust particles (dental caries tissue) mixed with air and water, and breaking free from dental instruments and devices.[11] The current paper reviews various studies relating to occupational health hazards in dental profession hoping to update previous studies.[12]

AIM AND OBJECTIVE

The aim of the present study was to determine the prevalence, knowledge, management and perceptions of percutaneous injuries among dental staff and students in Jizan, Saudi Arabia by.

1. Recording the frequency of occurrence of needle stick and sharps injuries experienced at the Oral and Dental Training Centers in Jizan, Saudi Arabia through a retrospective analysis over a period of time (2017-2018), and further to.
2. Determining the knowledge of current dental staff and students on the clinical management of such injuries and their perceptions through a cross-sectional study and by comparing current Departmental policies and clinical protocols with the recommended universal/ standard precautions on the management of percutaneous exposure injuries.

METHODOLOGY

A cross-sectional study used a self-administered questionnaire to determine the knowledge, management and perceptions of percutaneous exposure incidents among current dental staff and students in Jizan, Saudi Arabia. Information was collected regarding the understanding of percutaneous injuries, infection control practices, the reporting of the incident and the use of post-exposure prophylaxis. The sample was drawn from the dental clinical staff at Oral Dental Training Centers (dentists, dental therapists, oral hygienists and dental assistants) and dental therapy and oral hygiene students from Jizan, Saudi Arabia. Each individual, staff or student, was personally approached and invited to participate, having been informed that participation was voluntary. A stratified random sampling method based on the extent of clinical experience was used to divide the student study population (n=90) into sub-groups and a random sample was taken from each sub-group. Hence, the student sample included mainly second and third year students (n= 47) with a small selection (n=13) of first year

students whose clinical exposure was observation of dental procedures. The final sample comprised 70 members of staff and 30 students for a total of 100 and was viewed as representing the combined experience of those involved in the discipline. The response rate for staff was 93% and for students, 88%.

In addition, the current Hospital policy regarding percutaneous exposures was evaluated in comparison with a list of gold standard criteria as recommended by the Centre for Disease Control (CDC) for the management of percutaneous injuries. The data was captured in MS Excel, basic descriptive analyses completed and the files were imported into SPSS version 20.0 for further assessment.

RESULTS

The current sample

The cross-sectional study was conducted on a mixed sample which included both dental staff and students and in which the greater proportion were females.

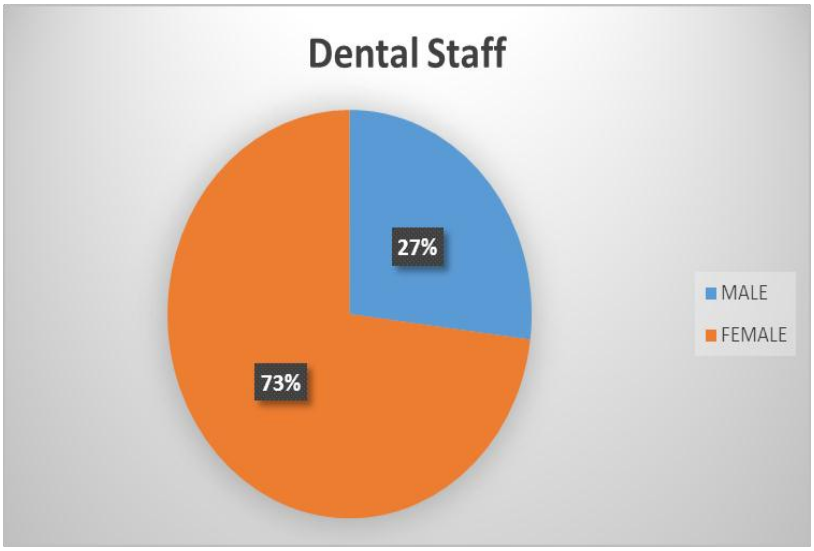


Chart 1: The proportion of the cross sectional study sample (Dental Staff).

Analysis of the self-administered questionnaire among this sample revealed that the majority of the study population had a good understanding of percutaneous injuries with more than half (56.2%) defining this as "where a practitioner has accidentally pricked/injected themselves with a needle, scaler or other sharp, infected instrument" and almost 15% indicated that they thought it was "a visible injury when there is a breach in the epidermis, affecting underlying blood vessels resulting in bleeding."

Most of the respondents (83%) recorded that they adhered to the practice of standard precautions when treating patients. Almost three quarters (74%) of those having had a PEI had previously completed three doses of the Hepatitis B vaccine, but only 41% had checked whether they had any immunity after taking the vaccine. More encouragingly, 44% reported having had a booster vaccine.

Table 3: The Category of the Oral Care workers who had percutaneous injuries.

CATEGORY	MALE	FEMALE	TOTAL
General Dentists	17	43	60
Dental Specialists	5	6	11
Oral Hygienists	0	6	6
Dental Assistants	0	13	13
Students	5	5	10
Total	27	73	100

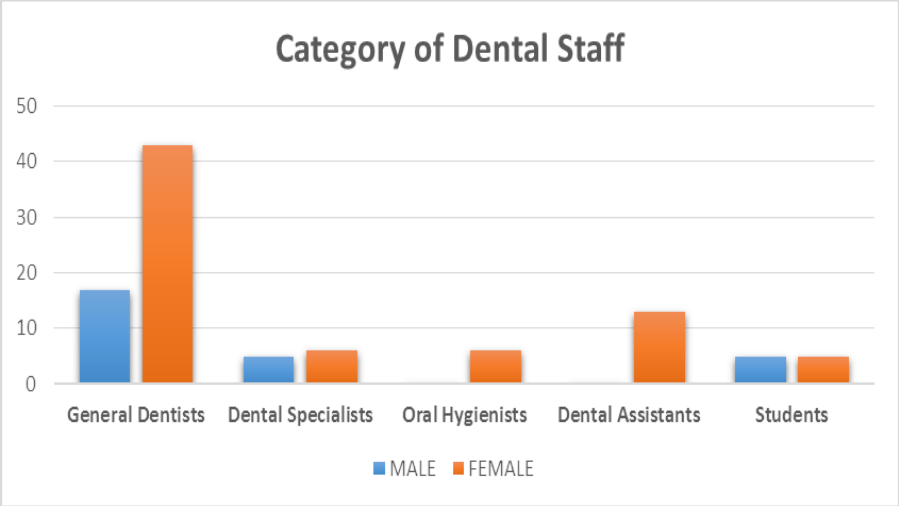


Chart 2: The Category of the Oral Health Care workers suffered with PEI

Amongst the current staff and student cohort, 22% reported having sustained a percutaneous injury. Of these, 43% had experienced at least one, more than half (57%) had suffered more than one injury and almost a quarter (24%) had experienced three or more PEIs.

More than a half of the injuries (57.9%) were due to mishaps with the dental syringe and needles. Injuries associated with the use of the dental elevator and Blade were also common (10.5% each).

Table 3: Cause of Percutaneous Injury in Dental Staff.

CAUSE OF INJURY	NUMBER	PERCENTAGE
Needle Stick	22	57.9%
Surgical Elevator	4	10.5%
Eye Splash	6	15.8%
Matrix Band	0	0%
Bur	10	26.3%
Blade	4	10.5%
Explorer	10	26.3%
Scaler	2	5.3%
Endodontic Files	17	36.8%
Lab Knifes	2	5.3%
Patient Bit My Finger	4	10.5%
Others	2	5.3%

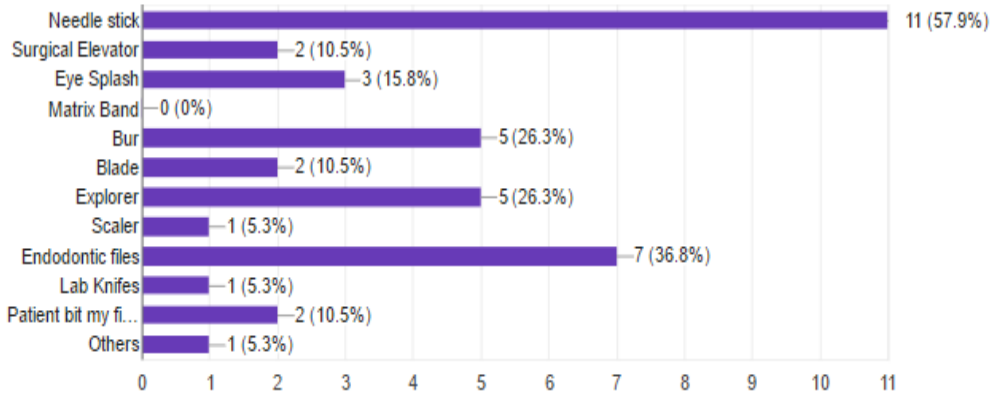


Chart 3: Cause of the percutaneous injury among the Dental Staff.

Most percutaneous injuries (63%) were caused during a minor oral surgery procedure. Nearly two-thirds (80%) of the injuries occurred to the finger, especially when a minor oral surgery procedure was being performed (20%).

Table 4: Part of the body Injured during Percutaneous Injury.

PART OF THE BODY INJURED	NUMBER	PERCENTAGE
Palm	4	10%
Forearm	4	10%
Foot	0	0%
Eye	4	10%
Cheek	0	0%
Thumb	12	30%
Finger	32	80%
Thigh	0	0%

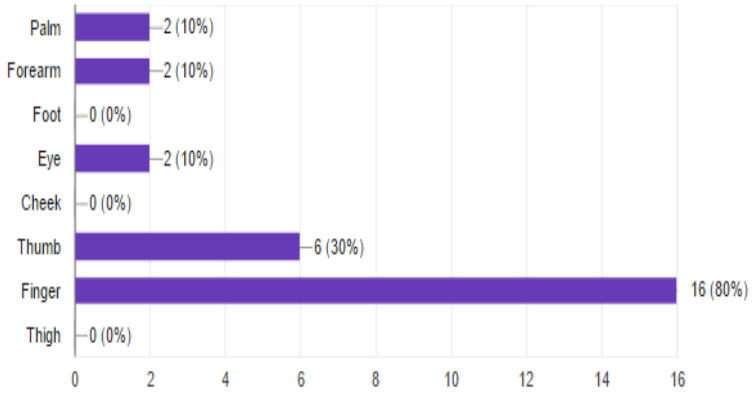


Chart 4: Graph showing the Percentage of the part of the body injured among Dental Staff.

Two out of every three incidents (66.7%) occurred during, and a quarter (25%) occurred after, the dental procedure, during the cleaning up process. Oral health care workers reported considerable emotional distress, displaying reactions of anxiety, fear, sadness and anger and some were totally devastated. Anxiety was the most common emotion reported by nearly quarter of the sample.

Table 5: Showing the Percentage of reaction of the Dental Staff after the injury.

REACTION AFTER INJURY	PERCENTAGE
Fear	16
Anger	14
Depressed	20
Anxious	24
Sad	16
Irritated	4
Devastated	2

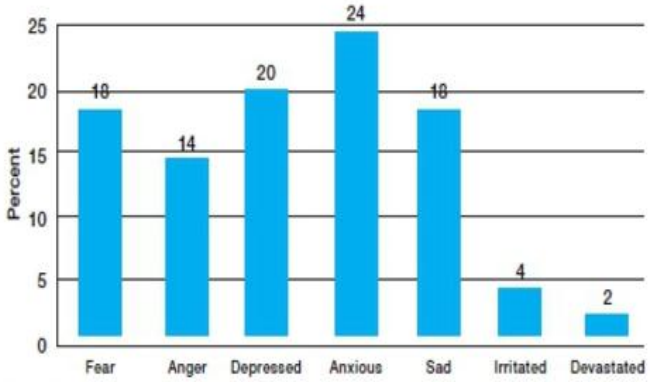


Chart 5: Graph showing the Percentage of Reaction of the Dental Staff after the injury.

Most respondents had reported the incident (81%) and those that had not had considered the injury too small to be of any significance, or that the source patient had been shown to be HIV negative whilst some thought there was no risk of infection or were unaware that they had to report the incident. Almost all the respondents who sustained and reported percutaneous injuries (94%) took the post exposure prophylaxis (PEP), however only 22.2% had taken the medication for the recommended period of four weeks.

More than half of the respondents (55.6%) had taken the PEP for between two to four weeks. Only 13.6% of those that incurred a percutaneous injury had the recommended full series follow-up blood tests and 18% did not have any follow-up blood tests at all.

Most of the respondents (86%) had received pre-test counselling, 68% received post-test counselling but only 23% had any follow-up counselling after an injury.

Table 6: Showing the Percentage of Counselling received by the injured Oral Health Workers.

COUNSELLING RECEIVED	YES	NO
Pre-testing	86.1	13.6
Post-testing	68	32
Follow up	23	77

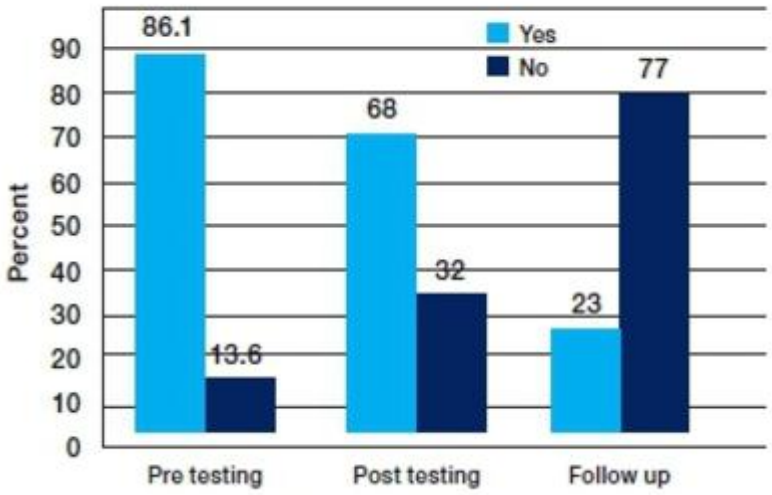


Chart 6: Percentage of Counselling received by the injured Oral Health Workers.

A structured data capture sheet was used in the evaluation of the ODTC policy for the management of percutaneous injuries (Department of Health Guidelines on Standard Precautions, Chapter 15). The policy adopted by the ODTC is in keeping with recommended

international guidelines for the management of percutaneous injuries (CDC, 2005) with a clearly defined aim, a designated occupational health officer and good referral systems in place. Post exposure prophylaxis is made available. Students are made aware of this policy during orientation at the beginning of each academic year.

Although the ODTC policy is in keeping with international guidelines, the following shortfalls were noted.

- The protocol is not clearly displayed on notice boards for staff and students to follow.
- There is very little in-service training offered.
- There is no induction training for new staff.
- Follow-up of student and staff after an injury is not ensured or monitored.
- There is no process for follow-up counselling.
- There is no monitoring or regular review of the policy.

DISCUSSION

By analyzing and investigating the causes of injuries, useful information may be gleaned. Information regarding the circumstances surrounding the reported injury may be valuable in preventing further injuries by modifying work practices. The needle was the most common source of injury among dental students and staff (57.9%). This finding increased when compared with previous studies which reported the syringe needle to be associated with 30-36% of all percutaneous injuries at a dental training institute.

Most injuries occurred when the needle was being withdrawn from the patient's mouth, while recapping the needle and when removing the used needle from the syringe.

Current safety measures recommended are the use of the "**one-handed scoop technique**" to recap used needles, placing a sharps container in each cubicle in the clinic to avoid staff walking around with contaminated needles and not removing needles using the hands but rather using an instrument such as artery forceps.... which may advantageously be attached to each sharps container. In addition to these measures, a device can be placed on the work surface that holds the needle sheath and allows for recapping without touching the sheath, or adopting the use of a safety syringe that has a sliding protective sheath over the needle. Another method of reducing accidents due to needles is the use of an incinerator in which the needle is completely incinerated after use leaving only the plastic hub which can then be harmlessly removed. These work practices are in keeping with the current CDC guidelines

which recommend that used needles should never be recapped, purposely bent or otherwise manipulated.

The surgical elevator was the instrument most often associated with injuries (10.5%) and it was also that most frequently contaminated with blood when the injury occurred. Mucosal eye splashes accounted for nearly a fifth of all percutaneous exposures (15.6%) which is suggestive of inadequate eye protection during dental procedures. These results are slightly higher than those found in the study by Siddiqi in 2008 (Coupland surgical elevator 9%, mucosal eye splashes, 15%).

Most of the injuries occurred while the operator was performing minor oral surgical procedures, followed in frequency by scaling and polishing and restorative procedures. Cleveland also found that while most percutaneous injuries occurred in oral surgical procedures, whilst the findings for other procedures differed: 19% of injuries were related to restorative procedures and 13% to oral hygiene procedures. Injuries occurring during minor oral surgical procedures can be reduced by strictly adhering to the latest standard precautions of double gloving and the use of blunt-tip suture needles as an alternative to the sharp product currently used. Blunt-tip suture needles have been shown to reduce needle stick injuries by 69%.

The present study, in agreement with similar studies conducted in other parts of Saudi Arabia showed that the finger of the non-dominant hand that plays a supportive role was the most common site of percutaneous injuries, followed by the eye.

Management of PEI

Percutaneous injuries were found to be appropriately managed at the ODTC. Eighty percent of the respondents who had sustained such an injury had reported the incident. This observation is commendable as previous studies have documented under-reporting as a universal problem. In addition, 70% of those who had sustained a percutaneous injury had sought medical attention at once. The transmission of HIV infection does not occur immediately on exposure, therefore the timeous initiation of post-exposure prophylaxis creates an opportunity for the antiretroviral drugs to modify or prevent viral replication thereby preventing systemic infection. Treatment should commence promptly, preferably 1-2 hours after the exposure and not later than 72 hours.

Post-exposure prophylaxis is made available to both staff and students at the staff clinic in the hospital. A basic regime of two nucleoside reverse transcriptase inhibitors (NRTIs) is prescribed and a protease inhibitor (PI) is given if the risk for transmission of HIV is considered high. The CDC recommendations state that a combination of Zidovudine (AZT 200mg every 8 hours) and Lamivudine (3TC 150mg b.d.) for 28 days should be considered for treatment of all exposures involving HIV-infected blood, fluid containing visible blood or other potentially infectious fluid or tissue. Indinavir should be added to this regime for high risk exposures. It was of concern, though, that there was poor final compliance as only 22% of those incurring a percutaneous injury had completed the recommended regime. Siddiqi *et al* also reported a low compliance to post exposure prophylaxis (7%). An important aspect of post exposure prophylaxis is the completion of a four week course of anti-retroviral when indicated. One of the reasons given for not completing the post exposure regime was not being able to cope with the side effects of the medication, about 46% of which included gastrointestinal problems, the medication making them feel sick, tired and nauseous.

It was also of concern that very few participants in the present study had follow-up testing. Occupational health and safety is an important issue in the work environment. Staff and students who are in the pre-employment phase should be educated about the importance of follow-up blood tests to check for sero-conversion. It is advisable for all staff and students who suffer a percutaneous injury to diarize their test dates and ensure that the follow-up tests are carried out timeously. At least the six month follow-up test should be done. It is also good practice for all health care workers working with blood to have an annual blood test.

In the present study, only a small cohort of the exposed population had received follow-up counselling. A percutaneous injury can impact negatively on a health care worker's personal life causing anxiety, fear and depression. The emotional distress can be severe and long lasting even though the risk of transmission is very low or there may be no transmission of serious disease. Therefore post exposure counselling is needed. However, this is not yet available at the Hospital as a routine option. An important lesson learnt from the current study is that a supportive environment and careful monitoring of the dental personnel after a percutaneous injury are important for total rehabilitation and readjustment to the work environment.

The following recommendations are suggested to prevent PEIs in dental training institutions.

- Protocols to be followed in the event of a percutaneous injury should be clearly displayed in the clinical areas;
- Percutaneous injuries should be carefully recorded and those records should be reviewed annually as an effective tool to determine the etiology and to make the relevant changes to work practices to prevent further injuries;
- The use of personal protective equipment (double gloves, mask and eye-shields) for every procedure should be reiterated;
- Adherence to safe work practices such as using the one-handed scoop technique to recap needles or a mechanical device that holds the needle cap should be encouraged;
- In addition to the adoption of safe work practices, institutions should identify, evaluate and select safety devices such as needle incinerators, needle guards and safety syringes for routine use.
- In-service training of safe work practices should be provided upon initial employment and when students first enter the clinical area and should be followed by continuous education on an annual basis to keep updated with current safe work practices and work modifications, and in the promotion of safety and prevention awareness to reduce or prevent percutaneous injuries.

CONCLUSION

A percutaneous exposure incident is a serious occupational health hazard that places dental staff and students at risk of transmission of blood-borne pathogens. The current study shows that percutaneous injuries are an ongoing problem at the ODTC and highlights the fact that dental personnel are at a higher risk of suffering percutaneous injuries than other health professionals working at the Sabya Hospital, Jizan, Saudi Arabia.

High risk activities have been identified, enabling recommendations on modifications of work practice to reduce the incidence of percutaneous injuries at the ODTC. Accidents are sometimes unavoidable but attending to a percutaneous injury as soon as it occurs, treating it as a medical emergency and following through with the management protocol are of utmost importance to prevent the transmission of blood-borne diseases. It is of concern that the present study revealed that personnel do not comply with management protocols regarding completion of post-exposure prophylaxis and follow up tests.

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