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REVIEW

Biosafety in Dentistry: A Comprehensive Approach to Workplace Accidents

Bioseguridad en Odontología: Un Enfoque Integral ante Accidentes Laborales

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ABSTRACT

Clinical dental practice presented a high risk of occupational accidents, especially sharps injuries, which exposed health care workers to contact with pathogens transmitted by contaminated blood and body fluids. These incidents, associated with sharps handling, frequently occurred due to factors such as inattention, stress and patient movement. Hollow needles were identified as the main cause of percutaneous injuries, accounting for 56 % of cases. Globally, health care workers reported infection prevalence rates 3-5 times higher than the general population. Against this background, universal biosecurity measures were highlighted as key tools to reduce the risks of disease transmission. These included barrier techniques, proper handling of contaminated waste and accident response protocols, ranging from immediate wound cleaning to administration of post-exposure prophylaxis within 2 hours of the incident. Studies indicated that a high proportion of accidents went unreported and that more than half of the professionals were unaware of biosafety protocols. This picture highlighted the urgent need for continuing education and supervision in the clinical setting, especially for students, who faced greater challenges due to their inexperience and constant exposure. Compliance with biosafety standards was crucial to minimise risks and ensure a safe working environment.

Keywords: Sharps Injuries; Biosafety; Occupational Accidents; Dentistry; Prevention.

RESUMEN

La práctica clínica odontológica presentó un alto riesgo de accidentes laborales, especialmente por lesiones cortopunzantes, las cuales expusieron al personal de salud al contacto con patógenos transmitidos por sangre y fluidos corporales contaminados. Estos incidentes, asociados a la manipulación de instrumentos punzocortantes, ocurrieron frecuentemente debido a factores como la falta de atención, el estrés y el movimiento del paciente. Se identificó que las agujas huecas representaron la principal causa de lesiones percutáneas, siendo responsables del 56 % de los casos. A nivel global, los trabajadores de salud registraron tasas de prevalencia de infecciones de 3 a 5 veces superiores a la población general. Ante esta situación, se destacaron las medidas universales de bioseguridad como herramientas clave para reducir los riesgos de transmisión de enfermedades. Estas incluyeron técnicas de barrera, manejo adecuado de residuos contaminados y protocolos de respuesta frente a accidentes, que implicaron desde la limpieza inmediata de la herida hasta la administración de profilaxis post-exposición dentro de las primeras 2 horas tras el incidente. Diversos estudios señalaron que una alta proporción de accidentes no se notificaron y que más de la mitad de los profesionales desconocían los protocolos de bioseguridad. Este panorama evidenció la necesidad urgente de educación continua y supervisión en el ámbito clínico, especialmente para estudiantes, quienes enfrentaron mayores desafíos debido a su inexperiencia y exposición constante. El cumplimiento de las normas de bioseguridad resultó crucial para minimizar los riesgos y garantizar un entorno laboral seguro.

Palabras clave: Lesiones Cortopunzantes; Bioseguridad; Accidentes Laborales; Odontología; Prevención.

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INTRODUCTION

Various studies over time have shown that dental clinical practice is at high risk for accidents. Sharps injuries are the most common type of injury affecting dental personnel. Every year, hundreds and thousands of healthcare workers are exposed to dangerous and deadly bloodborne pathogens through contaminated needle sticks and sharp injuries due to daily procedures in clinical activities.[1,2,3,4,5,6]

Healthcare workers have prevalence rates 3 to 5 times higher than the general population; thus, the annual infection rate among workers ranges from 0,5 to 5 % compared to the yearly incidence of 0,1 % in the general population worldwide.[4,5,7,8,9,10]

Dentists, and especially dental students, have a high accident rate due to their daily practice with rotary, ultrasonic, and sharp instruments in a restricted field of vision and subject to patient movement, being exposed to a wide variety of microorganisms present in the blood, saliva, and respiratory tract of patients, as well as accidental lacerations with needles and aerosols contaminated with blood and/or saliva ejected by high-speed equipment.[11,12,13,14]

Accidents usually occur due to several factors, such as:

- Lack of attention
- Limited time available
- Stress, nervousness
- Excessive force
- Patient movement, among others.[15,16,17,18]

DEVELOPMENT

Universal Biosafety Measures

These are measures to reduce the risk of transmission of infectious diseases related to the work of the Health Team. These precautions should be added to the appropriate Barrier Techniques to reduce the likelihood of exposure to blood, other body fluids, or tissues that may contain blood-borne pathogens.[19,20,21]

Biosafety means zero risk, total safety, and absolute sterilization. Technical standards for biosafety in dentistry have been developed internationally. These are defined as a set of basic universal procedures that all healthcare personnel must follow daily to limit cross-contamination. These include, among others, care for healthcare personnel, handling materials and instruments, managing the dental environment, using protective barriers, handling contaminated waste, and basic measures for accidents involving blood or body fluids exposure.[22]

Barrier techniques are procedures that involve the use of specific personal protective equipment, such as caps, safety glasses, face masks, gloves, smocks, aprons, and boots, to prevent contamination with microorganisms eliminated by patients and, in other cases, prevent microorganisms from healthcare personnel being transmitted to patients. It is necessary to recognize that the skin, mucous membranes, and body cavities are always colonized by microorganisms known as endogenous flora: viruses, bacteria, fungi, and sometimes parasites that do not affect the carrier because their defensive barriers are intact but can be introduced and become pathogens in the tissues of the same or other healthy or sick people when such defenses are damaged (skin or mucous membrane lesions or surgical wounds).[23,24]

It can also be defined as the set of basic procedures that all healthcare personnel must follow during their daily work when faced with risks to their health and the community. This includes, among other things, the care of healthcare personnel, the handling of materials and instruments, the management of the dental environment, the use of protective barriers, the management of contaminated waste, and basic measures for accidents involving exposure to blood or body fluids.[25]

Sharp objects

Sharp objects or materials are medical devices such as needles, scalpels, and other tools that cut or penetrate the skin.[22] According to a publication by the Centers for Disease Control and Prevention, six devices are responsible for nearly 80 % of all percutaneous injuries to healthcare personnel, with hollow needles accounting for 56 % of all sharps injuries. These are disposable syringes (30 %), suture needles (20 %), winged steel needles (12 %), scalpel blades (8 %), intravenous (IV) catheter stylet needles (5 %), and phlebotomy needles (3 %).[26,27]

Accident with sharp objects (percutaneous)

A percutaneous accident refers to an injury involving penetration of the skin by a needle or other sharp object contaminated with blood, other fluids containing visible blood, other potentially infectious fluids, or a patient's tissue.[28,29,30,31]

Any contact with blood or bodily fluids that involves a break in the skin (puncture or cut), contact with mucous membranes, or broken skin (eczema, excoriation, etc.) is a blood exposure accident.

Whenever such an accident occurs, the following must be determined:

- The victim or injured healthcare worker
- The material that caused the accident
- The procedure that led to the accident
- The source, i.e., the potentially contaminated blood or fluid.[20]

Also known as a puncture wound, a sharp wound is an accidental puncture wound that penetrates the skin with a hollow-bore needle (or any sharp object) containing blood or body fluids from another person. It is caused by sharp instruments and accidents in

a medical setting.[32,33,34,35,36]

The World Health Organization (WHO) emphasizes the implementation of universal infection prevention measures and the need to adequately train healthcare personnel to reduce the prevalence of sharps accidents in healthcare settings.[37,38,39]

What to do in the event of a sharps accident at work or outside of work:

1. Wash the wound thoroughly with soap and water.
2. In case of contact with mucous membranes, wash the affected area with saline solution or plenty of water.
3. If the conjunctiva is affected, wash thoroughly with saline or plenty of water.
4. Immediately report the incident to the department or clinic's head, noting the source (known or unknown) and the circumstances that led to the accident.
5. Refer the injured person to the appropriate medical center so that a specialist can determine the risks and the course of action to be taken. The proper medical center in Buenos Aires is the Francisco Javier Muñiz Infectious Diseases Hospital, Department of Infectious and Contagious Diseases, located at Uspallata 2272, CABA.

The injured person and the source (if known) will be treated in the Emergency Unit. A blood sample will be taken from the wounded person and the source (if known). Prophylactic measures will be taken.

6. The Post-Exposure Accident Report form must be completed and sent to the Healthcare Secretariat for registration and follow-up for one year.[40,41]

The type of exposure, the type of contaminating fluid, and the degree of exposure are the determinants of the potential risk of infection.

Post-Exposure Prophylaxis After initial treatment of the wound or contact area, the following points should be evaluated to determine the risks involved and the course of action to be taken:

1. Type of contact or exposure Percutaneous Mucous Intact skin
2. Contaminating fluid Blood Other bodily fluids (saliva, sweat, urine, feces, or other fluids with visible blood)
3. Serological status of the source: evaluation of the source HBs Ag, HCV, HIV.
4. Susceptibility of the injured person: evaluation of the exposed person HBV vaccination, Anti-HBs, HCV, and HIV baseline values Assessment of tetanus vaccination status.[42]

1. Type of contact or exposure: percutaneous, mucous membrane, or healthy skin. The kind of exposure, the contaminating fluid, and the degree of exposure are the determining factors of the potential risk of infection. Percutaneous exposure (mediated by a needle, scalpel, etc.) or contact with mucous membranes must be adequately assessed. Although the risk is low when contact occurs through healthy skin, skin lesions (wounds, erosions, inflammatory processes) significantly increase the possibility of transmission. Depending on the type of exposure, the risk is divided into:

- High-risk exposure: deep percutaneous exposure with evidence of blood, hollow needle used for intravascular injection.
- Low-risk exposure: circumstances that do not meet high or no risk criteria.
- No risk exposure: negative source, non-contaminating fluid, or if the exposed area is intact skin.

2. Type of contaminating fluid: contaminating fluids include blood, semen, vaginal secretions, or other bodily fluids with evidence of blood. The following are not considered potentially infectious: saliva, nasal secretions, sweat, tears, feces, urine, and sputum (unless containing visible blood).

3. Serological status of the source – source assessment: This defines the course of action to be taken, as this determines whether or not post-exposure prophylaxis is necessary. Although a specialist will determine the course of action, the following considerations are provided for information purposes: Serology for HIV, HBV, and HCV should be assessed. If the source's serology is negative, no baseline assessment or follow-up of exposed personnel is necessary. However, for medical-legal reasons, it is recommended that baseline testing always be performed if there are indicators of suspected acute or recent infection (serological window period).

The following serology should be requested (with consent) from the source: HIV (ELISA) HBs Ag – Anti HCV (ELISA).

4. Susceptibility of the injured person - assessment of the exposed person: The serological status of the exposed person must always be determined based on the serology of the source. A specialized professional shall carry out this risk assessment. If the source is unknown, it should be treated as positive.[15]

Treatment

When prescribing post-exposure prophylaxis, the following characteristics must be considered: higher, lower, or no risk of transmission; type of contaminating fluid; serological status of the source; and susceptibility of the accident victim, suppose the analysis of these variables leads to a recommendation for prophylaxis. In that case, post-exposure prophylaxis will be indicated, depending on the exposure level and the source's serological status.

It is important to note that post-exposure prophylaxis for HIV should ideally be started within 2 hours of the accident. However, prophylaxis may be considered up to 72 hours after the episode, depending on the severity of the exposure. "A sharp object accident, whether work-related or not, is an infectious disease emergency."[19]

A blood sample should be taken as soon as possible after the injury of the exposed person to serve as a baseline in case an infection occurs. Additional blood samples to detect HBV, HCV, and HIV are collected after one, three, six, and 12 months.[16]

Several authors have mentioned that up to half of sharps accidents are not usually reported, with all the implications that this entails,[15] in addition, 52,4 % of dentists are unaware of the existence of post-exposure protocols for pathogens during clinical work,[8] highlighting the need to educate these professionals about the risks to which they are exposed, thereby reducing occupational accidents.

It is essential that healthcare personnel, especially those in training, are aware of the biological risk to which they are exposed when working in a potentially contaminated environment and that they are clear about the procedures to follow in the event of an accident during their work in the clinic. For this reason, this descriptive, cross-sectional, quantitative study was designed which aims to determine whether students at the integrated adult clinics and Surgery III of the UAI School of Dentistry during the period 2024 are aware of the protocol to follow in the event of a sharps injury while carrying out their clinical activities.

CONCLUSIONS

Dental practice is a high-risk environment for occupational accidents, especially those involving sharp injuries. These incidents expose healthcare personnel to a significant risk of infectious disease transmission due to contact with blood and other contaminated bodily fluids. The studies reviewed highlight an alarming incidence of unreported accidents and limited adherence to biosafety protocols, highlighting the need to strengthen preventive and educational measures in this area.

The rigorous implementation of biosafety standards, such as the use of protective barriers and the correct handling of materials and instruments, is key to minimizing the risk of exposure. In addition, training and awareness-raising among healthcare personnel, including students, are essential to ensure safety in the clinical environment and promote adherence to post-exposure protocols.

Finally, the importance of timely reporting of accidents, adequate medical follow-up, and administration of post-exposure prophylaxis at the appropriate time to reduce the risk of infection is highlighted. This underscores the need for a comprehensive approach that combines education, adequate infrastructure, and constant supervision to mitigate the risks associated with dental activities, especially in academic settings where students are in training and face more significant challenges in ensuring their occupational safety.

FINANCING

None.

CONFLICT OF INTEREST

No conflict of interest.

AUTHORSHIP CONTRIBUTION

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