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Risk factors affecting occupational exposure to blood and body fluids among dental students: a cross-sectional study in a Brazilian Federal University

Fábio Fernandes Dantas Filho[1], Eunice Beatriz Martins Chaves[1], Maria Carlota Borba Brum[1], Francisco Jorge Arsego Quadros de Oliveira[1]

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1 Occupational Medicine Service, Hospital de Clínicas de Porto Alegre (HCPA). Porto Alegre, RS, Brazil.

Corresponding author:
Fábio Fernandes Dantas Filho
fffilho@hcpa.edu.br
Hospital de Clínicas de Porto Alegre (HCPA)
Rua Ramiro Barcelos, 2350.
90035-903, Porto Alegre, RS, Brazil.

ABSTRACT

Introduction: Dental students are often exposed to bloodborne pathogens during dental training. Several factors are involved in increased risk of human deficiency, hepatitis B and hepatitis C virus (HIV, HBV, and HCV) infection. However, there are few studies that address the risks and forms of prevention among dental students in Brazil.

Methods: A cross-sectional study of occupational exposure to blood or body fluids among dental students of Universidade Federal do Rio Grande do Sul, Brazil, was performed. These students were referred to the Occupational Medicine Department of Hospital de Clínicas de Porto Alegre from January 2007 to April 2015. Analyzed data included type of exposure (needlestick injury, mucosal exposure, and exposure to non-intact skin); source patient status for HBV, HIV and HCV infection, accident during dental training, procedure performed, biological material involved, type of accident, and hepatitis B vaccination and serological protection status. The objective was to know the incidence rate and others characteristics of accidents in order to prevent them.

Results: There were 312 accidents during the study period of 8 years and 4 months. Incidence rate was 87,42 exposures per 1000 students year. Source patient was known in 297 of the cases (95.2%), of which 3 were HBsAg reagent, 12 were HIV reagent, and 17 were HCV reagent. The majority of accidents occurred during procedure, but nearly as high as 40% occurred after procedure, of which 63% occurred during instrument cleaning, disinfecting or sterilizing. Most involved sharp instruments were anesthetic syringe needle and curette. Only 48% of dental students knew their anti-HBs was > 10 mIU/mL.

Conclusions: Dental students should be tested for hepatitis B immune status at the beginning of training, and vaccination should be available to all dental students before they start clinical practice. Work practice controls on sharp devices should be addressed at the beginning and strengthened during dental training. Dental training institutions should review instrumental cleaning process to minimize handling of loose contaminated instruments.

Keywords: *Dental students; occupational exposure; bloodborne pathogens; sharp injury; needlestick injury*

Health-care workers (HCW) are at increased risk of infection with bloodborne pathogens because of occupational exposure to blood and other body fluids. Most exposures among HCW are caused by percutaneous injuries with sharp objects contaminated with blood or body fluids, including but not limited to needles, scalpels, lancets, and broken glass[1]. The pathogens most commonly transmitted to HCW in occupational settings are the hepatitis B and C viruses (HBV, HCV) and the human immunodeficiency virus (HIV)[2].

Dental health-care personnel (DHCP) refer to all paid and unpaid personnel in the dental health-care setting who might be occupationally exposed to infectious materials. DHCP include dentists, dental

assistants, dental laboratory technicians (in-office and commercial), students and trainees, contractual personnel, and other persons not directly involved in patient care but potentially exposed to infectious agents (e.g. administrative, clerical, housekeeping, maintenance, or volunteer personnel)[3]. DHCP are subject to conditions that favor occupational exposures to biological material, such as procedures in the oral cavity – which is a small environment, with difficult access, and colonized by different organisms – and the use of sharp instruments and rotary equipment that can generate contaminated aerosol[4]. Dental patients and DHCP can be exposed to pathogenic microorganisms, including cytomegalovirus, HBV, HCV, herpes simplex virus types 1 and 2, HIV, Mycobacterium tuberculosis, staphylococci, streptococci, and other viruses and bacteria that colonize or infect the oral cavity and respiratory tract. The opportunity for transmission is greatest from patient to DHCP, who frequently encounter patient blood and blood-contaminated saliva during dental procedure[3].

The risk of occupational exposure to bloodborne viruses is largely determined by their prevalence in the patient population and the nature and frequency of contact with blood and body fluids through percutaneous or permucosal routes of exposure[3]. Dental students are at higher risk of bloodborne virus transmission because proper manual skills and clinical experience are limited, which leads to higher incidence and severity of needlestick injuries during clinical training[4].

Dental students have a tendency to low compliance on reporting occupational exposure. Reasons for this are not yet fully enlightened, but some studies found that dental students believe that reporting is time consuming, not necessary, and would not influence the outcome, and most students do not know how, where, and to whom exposures should be reported. Also, high workloads may prevent them to report[5-7]. Some studies estimated that unreported sharp injuries may be ten times more frequent than the reported cases[8]. In two studies conducted in Iran, 85% and 90% of students respectively did not report their injuries[9,10]. Because of the few number of reports, post-exposure prophylactic management is not possible in many cases[7]. The objectives of this study are to identify risk factors affecting exposure of dental students to bloodborne pathogens during dental training, to address students HBV seroprotection through vaccination and anti-HBs dosage and to identify preventive measures to decrease the risk of infection.

METHODS

This is a cross-sectional study of occupational records of all accidents with exposure to blood or body fluids among dental students referred to the Occupational Medicine Department of Hospital de Clínicas de Porto Alegre between January 2007 and April 2015. The population at risk were all dental students of the School of Dentistry of Universidade Federal do Rio Grande do Sul who were at risk of exposure during dental training, making a total of 437 students-year. The incidence rate was estimated as per 1,000 dental students-year. Analysis addressed the source patient status, moment of accident regarding procedure, type of material involved, hepatitis B vaccination, and serological protection, with the purpose of estimating the incidence rate and others characteristics of accidents in order to avoid them. All dental students assisted at the Occupational Medicine Service after accidental exposure to biological materials were included. Data collected included type of accident, time of occurrence, body fluid involved, sharp instrument that caused the accident (when applied), risk assessment, post-exposure management and follow-up.

RESULTS

A total of 312 accidents involving dental students with exposure to biological material were registered in the period, of whom 245 were female and 67 male. The incidence rate was calculated as 87.42 exposures per 1,000 students-year at risk. The mean age of dental students was 22.9 years. As for the time of the accident, 189 (60.6%) occurred during procedure, and 123 (39.4%), after. When analyzing only accidents that had occurred after procedure, 77 (62.6%) were related to cleaning, disinfecting or sterilizing sharp instruments and 46 (37.4%) to disposal of sharps. Regarding the biological fluid involved, report of direct contact with “blood” or “saliva with visible blood” represented 91.4% of total accidents, while 8.6% involved report of “saliva” only. A total of 283 dental students (90.7%) recorded having at least three doses of HBV vaccine (figure 1). Conversely, only 48.4% of those knew they had Anti HBs > 10mIU/mL (figure 2). The source patient was known in 297 (95.2%) of the cases, of which 3 (1.0%) were HBsAg reagent; 12 (4.04%) were HIV reagent, and 17 (5.72%) were HCV reagent (figure 3). Regarding the sharp material involved: 82 (26.3%) of accidents were related to anesthetic syringe needle, 67 (21.5%) to curette, 16 (5.1%) to dental drill, 15 (4.8%) to surgical needle, 13 (4.2%) to dental scalpel, and 6 (1.9%) to dental lever. The remaining cases were related to other instruments or no sharp material was involved.

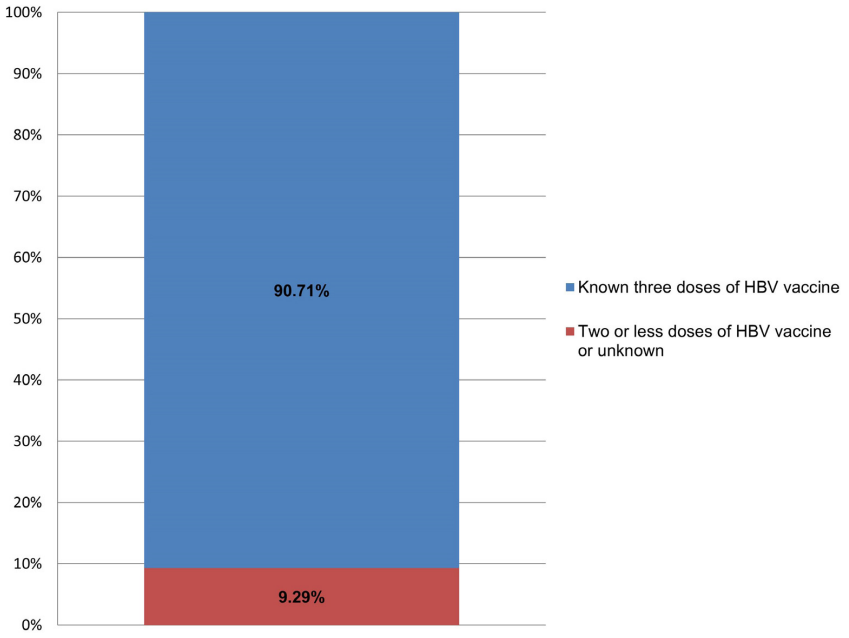

Figure 1: HBV vaccination among dental students at the time of the exposure.

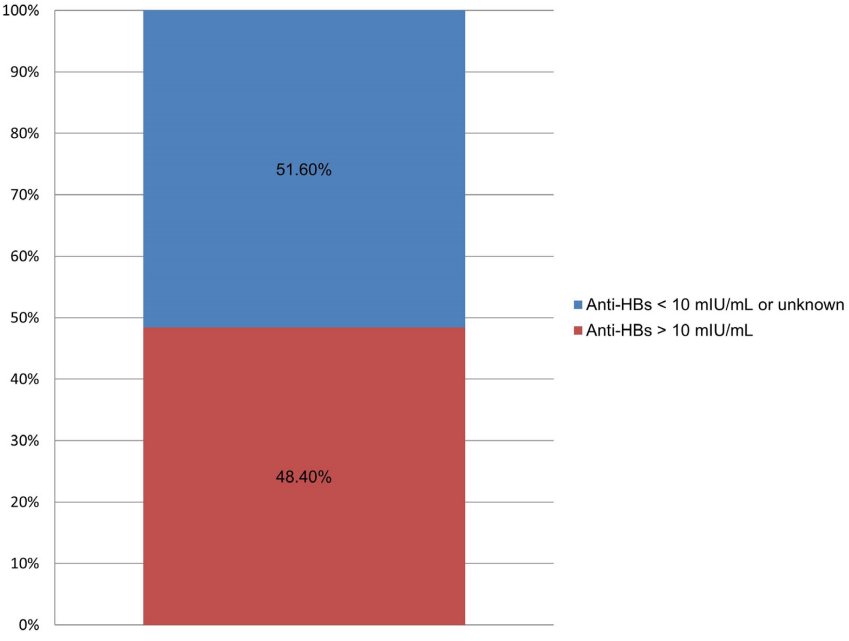

Figure 2: Anti-HBs status knowledge among dental students at the time of the exposure.

No HBV, HCV or HIV infection occurred from patient to dental student during the analyzed period.

DISCUSSION

The dental health-care setting is an environment where disease transmission occurs easily. Infections may be transmitted in the dental operatory through direct contact with blood, oral fluids or other secretions; via indirect contact with contaminated instruments, equipment or environmental surfaces; or by contact with airborne contaminants present in either droplet splatter or aerosols of oral and respiratory fluids[11]. Strategies to prevent dental patient infections have focused on disinfection and sterilization. The majority of exposures in dentistry are preventable, and methods to reduce the risk of blood contacts have included

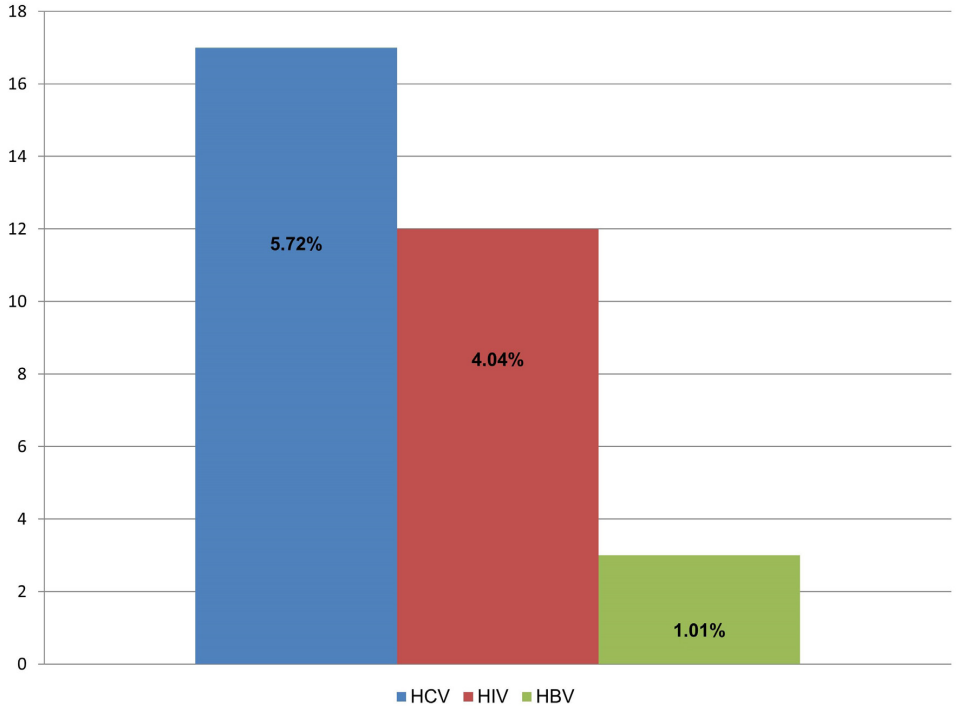

Figure 3: Risk assessment regarding HBV, HCV and HIV status in known source patients at the time of exposure.

use of standard precautions, use of devices with features engineered to prevent sharp injuries, and modifications of work practices[3].

Immunizations are an essential part of prevention. Our data show that, although a high number of dental students reported completion of the three-dose HBV vaccination series prior to or during academic training, most of these students were not systematically tested for or did not know their anti-HBs serological status. This also occurs with DHCP. A study conducted with Saudi dentists showed that 94,5% of them were vaccinated against HBV, but only 48,6% knew their serological status for anti-HBs[12]. Similarly, studies with Nigerian dentists and dental assistants showed similar results[13,14]. A guideline published in February 2014 by the Swiss Federal Office of Public Health recommended that all DHCP should have at least one valid protection against hepatitis B, measles, mumps, rubella, influenza, varicella, diphtheria, tetanus, poliomyelitis, and pertussis[15].

Needles are a substantial source of percutaneous injury in dental practice, and engineering and work practice controls for needle handling are of particular importance[3]. The majority of accidents with sharp materials in our data involved anesthetic syringe needle as the main source of accident.

Almost 40% of accidents occurred after procedure, most of which during cleaning, disinfecting or sterilizing instruments. This high incidence of sharp injuries related to cleaning instruments in dental training is consistent with published reports from several other studies in dental educational settings[16,17]. This finding suggests that work practice controls on handling, disassembling, processing and specially on cleaning sharp devices are not systematically addressed at the beginning of dental training nor strengthened during the training practice. Some authors also highlighted the need to review the number of stages and need for repeated handling of the instruments in the instrumental cleaning process (figure 4)[17].

Most of dental students' needlestick injuries could be preventable with standard precautions – such as gloves, masks, protective eyewear or face shield, gowns, and protective equipment – and work practice control training. Although engineering controls are the primary method to reduce exposures to blood and body fluids from sharp instruments and needles, these technology-based safer designs of instruments and devices are not always available in dental training or practice.

Dental training facilities should address education based in work practice controls for needles and other sharps in the beginning of the training, and should periodically assess dental students´ compliance to these controls, especially to the ones that minimize contact with sharp instruments if manual cleaning is necessary. Dental training institutions should also review instrumental cleaning processes to

Figure 4: Common sharp instruments used in dental training.

contaminated instruments. Automated cleaning equipment (e.g. ultrasonic cleaner or washer-disinfector) should also be encouraged. Wear puncture- and chemical-resistant/heavy-duty utility gloves for instrument cleaning and decontamination procedures and wear appropriate personal protective equipment (e.g. mask, protective eyewear, and gown) when minimize handling of loose splashing or spraying is anticipated during cleaning[3].

Hepatitis B vaccination should be checked in the beginning of dental training and anti-HBs should be tested universally. When vaccination cannot be confirmed, or when anti-HBs is below 10 mIU/mL, vaccination should be available to all dental students before they start clinical practice.

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