The assessment of infection control in dental practices in the municipality of São Paulo

ABSTRACT

Objective: The goal of this study was to evaluate the infection control measures actually implemented by dental surgeons during dental practice, as patients and professionals are exposed to high biological risk in dental care environments. **Method**: 614 questionnaires (90.69%) were answered by professionals registered in updating or in post-graduate courses in the Municipality of São Paulo. **Results**: Out of surveyed professionals 30.62% admitted that surface protection barriers were not used, whereas 34.17% were using non ideal or outdated pre-disinfection practices. The autoclave was used by 69.38% of participants, although 33.80% were not monitoring control of the sterilization cycles. Chemical and biological indicators were not used simultaneously by 83.21% of respondents and were not employed on a daily or weekly basis by at least 81.75%. Dubious methods of sterilization were cited by 44.77%. Occupational accidents caused by cutting and piercing objects were reported by 47.88%; however, the biologic risk was underestimated by 74.15% of the professionals who suffered the accidents. Irritant solutions were used as an antiseptic agent by 18.55%. **Conclusions**: Infection control measures reported by dental surgeons during their practices are deficient. It is necessary to educate, raise awareness of professionals, and promote constant updating courses on procedures which aim at improving safety of dental care.

Keywords: infection control; sterilization; occupational accidents; dentistry.

[Braz J Infect Dis 2011;15(1):45-51]

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INTRODUCTION

Biosafety is a concern in all health sector services. Confronted with a high biological risk both for patients and professionals in dental care and due to the constant development of new technologies, information, equipment, material and behavioral attitudes in this area,[1-3] Health Organizations such as the Center for Disease Control (CDC), the American Dental Association (ADA), the National Sanitary Department (ANVISA) and the Ministry of Health (MOH) among others, have developed guidelines to prevent, minimize or eliminate any threat to life or health during treatment. These guidelines, given the peculiarities of dentistry activity, should be followed by the professional and his team before, during, and after care for all patients and for all types of treatment. This includes all instruments and equipment used, regardless of the confirmed or presumed diagnosis, being infectious or not.[4-5]

The environment in dentistry practices and clinics is far from ideal.[6] However, the adoption of infection control measures is an effective way to reduce occupational risk and the transmission of pathogens, mainly through saliva, blood, air or water. These measures essentially include (I) cleaning, disinfection and sterilization; (II) the use of personal equipment protection; (III) immunization; (IV) prevention and correct handling in occupational accidents which involve exposure to blood and bodily fluids; and (V) antisepsis.[7-9]

Still, written reports have shown that the most common biosafety problem is not related to available technology to eliminate or minimize risks, but rather the behavior of professionals.[1-3;10]

A well-informed and alert professional is capable of performing his procedures without putting himself at risk or the health of his patients. Consequently, the goal of this study was to assess current infection control measures adopted by dental surgeons during their practice.

Submitted on: 06/09/2010
Approved on: 07/27/2010

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We declare no conflict of interest.

METHOD

Between March 1st and April 30th 2009, self-administered structured questionnaires were offered to 677 professionals registered in updating or post-graduation courses in the Municipality of São Paulo, regardless of sex, age, field of expertise or graduation period.

Professionals from different specialties from the following institutions were included: Abitep; Fapes; Unip; Fousp; Uniban; Cetao; APCD Ipiranga and Funorte Tatuapé. The criterion for the selection of these institutions was the easiness of access and gathering data.

Questionnaires with less than 70% of completed answers were excluded. Therefore, the sample consisted of 614 (90.69%) participants, which corresponds to 26.24% of the total sample enrolled (N = 2.340) in specialization courses ongoing in the State of São Paulo, according to the Federal Dentistry Council (site).

Questionnaires were handed out to the selected professionals with no prior contact between the researcher and professionals. A pilot test was conducted with 10 professionals to assess the validity of the research instrument, followed by obtaining signed consent from study participants.

The information gathered in the questionnaires dealt with the following areas: (I) general information of participants: sex, age, period since graduation, post graduation, clinical procedures, and patient attendance systems; (II) infection control in dental clinics characterized by: a) use of surface protective barriers, b) usages of disinfectants, c) methods of sterilization, both physical and chemical, d) monitoring of sterilization processes in autoclave through chemical and biological indicators; (III) occupational accidents and immunization defined by: a) cases of exposure to biological materials, b) products used on injured areas, c) vaccinations against immune-preventive illnesses.

The research project was approved by the Committee for Ethical Research of IAMSPE (protocol nº 067/07).

RESULTS

Table 1 shows demographic and educational information of the of the 614 dental surgeons surveyed; 70.36% were female, the mean age was 34 years, and 46.58% had been graduated for 10 years or more. The majority (54.72%) had postgraduate training, with specializations mainly on endodontic (18.90%) and dental implant (12.93%). A high percentage (87.30%) performs surgical procedures, 46.34% of professionals assisted patients from the public sector and both private and health insured patients; 44.67% provide care to private patients only, 6.66% worked at the public sector, and 2.33% with health plans.

Table 1. Demographic and educational information of the 614 dental surgeons surveyed

History frequency (N)	Absolute frequency (%)	Relative
Gender		
Female	432	70.36
Male	182	29.64
Age (years)		
21 to 30	210	34.20
31 to 40	246	40.06
41 to 50	108	17.59
51 to 60	34	5.54
Over 60	16	2.61
Time period since Graduation (years)		
0 to 4	142	23.13
5 to 10	186	30.29
Over 10	286	46.58
Post Graduation	336	54.72
Specialty		
Endodontics	76	18.90
Implantology	52	12.93
Prosthodontics	46	11.44
Pediatric Dentistry	40	9.95
Periodontics	34	8.46
Dentistry	32	7.96
CTBMF	26	6.47
Others	96	23.88
Perform procedures		
Surgical	44	7.17
Non surgical	78	12.70
Surgical and non surgical	492	80.13
Patient attendance		
Private	268	44.67
Public Service	40	6.66
Health/Dental Insurance	14	2.33
More than one attendance	278	46.34
	Average	**(Minimum-Maximum)**
Age (years)	34	(21 - 72)
Time period since Graduation (years)	10	(01 - 46)

*Updated and Postgraduation courses: Abitep; Fapes; Unip; Fousp; Uniban; Cetao; Apcd; and Funorte.

Table 2 shows the infection control methods used by the surveyed professionals in dental clinics. It was observed that 69.38% used protection barriers on surfaces. Almost all of them (95.11%) reported pre-disinfection of tools used in the surgeries. However, a closer analysis of the results indicated that 65.83% of dental surgeons showed a misunderstanding between manual hygiene practices (53.45%) or automated hygiene practices (12.37%), with pre-disinfection (34.17%). The solution most commonly used for pre-disinfection was glutaraldehyde at 2% (19.71%). The autoclave was adopted by 69.38% of participants.

In Table 3, the usage, frequency and the types of indicators of sterilization are presented. It was observed that 66.7% of professionals used monitoring indicators for the autoclave. The majority referred a frequency greater than 30 days (34.31%). Biological indicator (47.44%) was the most frequent, followed by chemical indicator (35.77%) and a combination of the two types (16.79%).

Table 4 shows that not only the autoclave (55.23%) but also the dry-heat sterilizer (8.75%), chemical solutions (19.32%) and alcohol (16.66%) were used as a means of "sterilization" for any type of dentistry equipment and tools.

Table 2. Absolute and relative frequency referring to the methods of infection control in dental clinic of 614 dental surgeons surveyed from 03/01/09 to 04/30/09 and enrolled in updating courses or post-graduation in the Municipality of São Paulo

Utilized methods for infection control	Absolute frequency (N)	Relative frequency (%)
Barrier protection of surfaces		
PVC film / coating latex	426	69.38
Pre-disinfection of objects	584	95.11
Pre-disinfection practice		
Soap and water/detergent	212	22.22
Enzymatic detergent	198	20.75
Glutaraldehyde at 2%	188	19.71
Ultrasonic washer	102	10.69
Alcohol	100	10.48
Dencrusting solution	100	10.48
Sodium hypochlorite	32	3.35
Thermo-disinfectant washer	16	1.68
Formaldehyde	6	0.63
Sterilization methods		
Oven	66	10.75
Autoclave	426	69.38
Oven and Autoclave	122	19.87

Table 3. Number and percentage of usage, frequency and the types of indicators of sterilization used in autoclave of 614 dental surgeons surveyed

Autoclave	Absolute frequency (N)	Relative frequency (%)
Reports to use indicator	282	66.20
Frequency		
Daily	10	3.65
Weekly	40	14.60
Every 2 weeks	40	14.60
Monthly	90	32.85
Less than once a month	94	34.31
Indicator type		
Biological	130	47.44
Chemical	98	35.77
Biological and Chemical	46	16.79

Table 4. "Sterilization" methods employed for some dental materials and instruments used by 614 dental surgeons

Material and instruments	Autoclave N (%)	Oven N (%)	Chemical solutions N (%)	Alcohol 70% N (%)	Total N
Orthodontic pliers	282 (56.17)	38 (7.57)	48 (9.56)	134 (26.69)	502
Diamond point	364 (52.15)	82 (11.75)	224 (32.09)	28 (4.01)	698
Turbine handpiece	278 (39.26)	14 (1.98)	106 (14.97)	310 (43.78)	708
Almagam plugger	484 (77.07)	100 (15.92)	30 (4.78)	14 (2.23)	628
Dental mirror	518 (78.48)	102 (15,45)	32 (4.85)	8 (1.21)	660
Surgical instruments	524 (80.37)	94 (14.42)	32 (4.91)	2 (0.31)	652
Endodontic files	482 (77.74)	88 (14.19)	48 (7.74)	2 (0.32)	620
Impression tray	430 (66.36)	86 (13.27)	76 (11.73)	56 (8.64)	648
Glass plates	252 (36.95)	28 (4.10)	140 (20.53)	262 (38,42)	682
Amalgam carrier	388 (65.10)	70 (11.74)	62 (10.40)	76 (12.75)	596
Film holder	158 (24.31)	4 (0.61)	332 (51.08)	156 (24.00)	650
Dappen pot	202 (31.76)	14 (2.20)	158 (24.84)	262 (41.19)	636
Prophylaxis cups	220 (35.71)	6 (0.97)	318 (51.62)	72 (11.69)	616
Total	4,582 (55.23)	726 (8.75)	1,606 (19.36)	1,382 (16.66)	8,296

Occupational hazards as well as preventive and prophylactic actions taken in case of such occurance are summarized in Table 5. Occupational accidents with cutting and piercing objects potentially contaminated 47.88% of professionals. Among the victims, only 25.85% sought specialized medical assistance. Of these, 42.10% received antiretroviral drugs and 5.26% vaccination for hepatitis B. The majority (92.62%) already had received the full course of hepatitis B immunization. However, only 65.85% had serologic ascertainment of the vaccine effectiveness and out of those 92.82% were immune. The vast majority of dental surgeons (95.76%) prioritized usage of some type of product to clean areas injured by sharp puncturing objects, potentially contaminated. Soap and water (52.04%) was the product most frequently mentioned.

Table 5. Occupational hazards, preventive measures and prophylactics adopted for biological exposure of 614 dental surgeons surveyed

Occupational hazard / measures	Absolute frequency (N)	Relative frequency (%)
Occupational hazard		
Accident with cutting and piercing objects	294	47.88
Patients that sought specialized assistance	76	25.85
Needed antiretroviral	32	42.10
Needed anti-HBV vaccine	4	5.26
Preventive measure		
Anti-HBV vaccine	596	97.07
Complete dosage	552	92.62
Serologic test	362	65.58
Immunized	336	92.82
Prophylactic measures		
Topic product pos-exposure	588	95.76
Types of products utilized		
Soap and water	460	52.04
Chlorhexidine	140	15.84
Alcohol	102	11.54
Hypochlorite	90	10.18
Hydrogen peroxide	74	8.37
Povidone iodine	18	2.04

DISCUSSION

Dentistry is a profession that involves constant risk of exposure to various environmental and human infectious agents, transmitted through blood, oral and oropharyngeal secretions, air and water.[11] Contamination can affect staff, patients and even members of their family. Occupational hazards involving blood and other organic fluids account for the most frequent exposure resulting in a higher risk of contracting diseases such as HIV, hepatitis B and C, meningococcal disease, mononucleosis, herpes, among others.[12,13] In the light of these facts, we highlight some actions that ought to be adhered to in order to reduce the risks in the practice of dentistry: (I) cleaning, disinfection and sterilization; (II) the usage of barriers and protective equipment; (III) immunization; (IV) prevention and handling of occupational hazards; (V) antisepsis.[14,15]

However, the literature shows that these actions are not always seriously implemented by professionals despite of their relevance and the large number of publications related to this subject.[1-3,10] Towards that end, to obtain effective control of contamination in dentistry environments it is necessary to further educate on health and raise awareness of professionals to the risks of exposure, as well as to the prevention of transmitted pathogens, through accurate and updated information.

Some of the data obtained in our study, conducted with participants of upgrading and postgraduate courses, deserve special consideration, as it reveals the flaws and needs in biosafety dentistry.

The utilization of protection barriers aims at minimizing the contamination of surfaces and equipment by microorganisms existing in the environment or on the hands of the professional.[16] A study carried out by Bulgarelli *et al.*[17] emphasizes that the use of disposable barriers for each patient reduces bacterial contamination by 70%. Despite easy availability of this resource, 30.62% of participants reported not to make use of it which may translate the indifference to preventive measures and cross contamination control. This finding underscores the need for adjustment and change in habits.

Prior disinfection is characterized by soaking the instruments contaminated by organic material in chemical disinfectant solutions, before cleaning, in order to reduce risks of pathogen exposures to the professional. However, research shows that this practice is not based on scientific evidence, as the organic material can interfere in the antimicrobial activity of disinfectants.[18-20] As such, prior disinfection admitted by 34.17% of those surveyed is no longer recommended, as besides giving a false sense of safety when handling objects, there is no evidence that it reduces hazard risks. Persistence in this

practice is probably justified by the absence of pertinent information.

Asymptomatic patients, whether carriers of infectious diseases or not, are assisted by dental surgeons every day, making sterilization processes and validation of paramount importance. In our research, autoclave (moist-heat by steam), oven (dry-heat sterilizer), chemical solutions and alcohol were analyzed as methods of "sterilization".

Autoclave is considered the preferred method due to its safety, quickness and its lethal effect of pressurized steam on all microorganisms.[5,7,18] Nonetheless, recent studies have shown that 12% to 33% of these devices present defects[21] easily detectable with periodical monitoring of the cycles and the simultaneous use of different sterilization indicators.[22] Findings by Monarca *et al.*[23] and by Corrêa[24] show respectively, 68.60% and 72.55% of autoclave users with 27.40% and 26.95% referring no use of indicators. Similar results were observed in our study, where 69.38% of participants used autoclave and 33.80% of these did not use indicators. Daily use or at least weekly us of indicators, as well as the combined use of different indicators, were ignored by 81.75% and 83.21%, respectively. The free use of material and/or instruments with no certification of correct sterilization is a large concern in respect to biosafety.

The literature describes the oven as a secure method for sterilization, but it is less appropriate than the autoclave, mainly as it permits the interruption of process, by the heterogeneity of penetration and heat distribution inside the chamber, by the absence of a precision thermostat to effectively control temperature and because it requires prolonged exposure to high temperatures.[21] Due to these issues, sterilization in a dry-heat sterilizer which seemed to be the practice of approximately 10% of the participants in our research is currently recommended just for metal blades, points, cutting or drill instruments sensitive to oxidization by steam.[25]

Chemical solutions are also referred to as sterilizers provided their concentration and length of exposure.[7] They are also considered toxic and irritant, with limited action and effectiveness. Therefore they are restricted to thermo sensitive material and are used as a last resource for sterilization, on scientific grounds.[18] Although alcohol at 70% eliminates the majority of microorganisms found on equipment and surfaces, it is not sporicidal and is just an intermediate-level disinfectant agent.[19] In the light of this and the data obtained in Table 4, we emphasize that choice of using the dry-heat sterilizer (8.75%) and chemical germicides solutions (19.36%) to sterilize equipment should be discouraged and have its effectiveness evaluated through strict parameters. Alcohol (16.66%) as a method of sterilization is totally unacceptable. Therefore, ineffective methods (44.77%) with subsequent transmission of infection and risking patients and professionals' health must be substituted.

Many dentistry instruments are sharp and piercing and can easily cause lesions when handled. This type of accident, mainly with exposure to blood or bodily fluids should be treated as urgency, as the fastest the prophylaxis is initiated, the better the prognosis.[26] In our data we identified 47.88% of dental surgeons who reported accidents with potentially contaminated material. However, biological risk was overlooked in 74.15% of these incidents, since only 25.85% sought specialized medical assistance and of these, 42.10% were instructed to begin antiretroviral chemoprophylaxis and 5.26% received vaccination against hepatitis B. Our results also confirm that 92.62% of dental surgeons had full vaccination course for anti-HBV, although 34.42% of them have not subsequently ascertained serological response. Such neglectful behavior was also detected by Gordon *et al.*[27] and Reis[28] who concluded in their studies that despite the frequent occurrence of incidents involving cutting and piercing objects, the risks of infection are underestimated by the professionals. A greater number of accidents, however, with fewer people seeking specialized assistance and serological monitoring were observed in other studies, such as reported by Veronesi *et al.*,[29] in Italy, where they found 73% of accidents, with 28.2% not verifying seroconversion, and a maximum of 44.94% of awareness of risk of infection. As in the study by Khadar,[30] in Jordan, there was 66.50% of accidents, with only 22.10% reported lesions. Based on this, it is crucia to understand that implementation of available preventive measures and effective prophylactics interventions should be based on individual analysis of the risk of infection.

According to Silva *et al.*,[31] exposure to biological materials represents the principal occupational risk to health professionals who deal with patients directly. The nature of accidents evaluated in his study indicated that the majority of them were percutaneous (92.4%), affecting mainly fingers (84.6%) and involving blood as biological material (86.3%). In a study by Lima *et al.*,[32] an anesthetic needle (19.4%) and an exploratory probe Nº 5 (16.4%) were the most frequently mentioned instruments. Appropriate care of the injured and exposed area is essential, highlighting: do not squeeze or enlarge in any way the lesion and cleanse the injured skin[26] with soap and water (52.04%), chlorhexidine (15.84%) or antiseptic liquids such as povidone-iodine 10% PVPI (2.04%) or alcohol 70% (11.54%). The use of irritant solutions such as hypochlorite (10.18%) and hydrogen peroxide (8.37%), seen in our study, are not recommended as an antiseptic as they worsen the wound

and facilitate infection.[28] This way, professionals should be fully aware and adhere to information of the correct guidelines in case on an accident.

CONCLUSION

Taking into account the initial proposal and the results obtained, we can conclude that infection control actions implemented by dental surgeons in this study in their dental practice are far from ideal. The critical points observed were: absence of protective barriers on surfaces; use of non recommended methods of disinfection; use of ineffective methods of sterilization; lack of monitoring of autoclave sterilization cycles; failure to use indicators; negligent behavior in post occupational accidents; and use of irritant antiseptic solutions. It is necessary to educate, raise awareness of professionals, and promote constant updating courses on procedures aiming at improving safety in the dentistry practice.

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