

Evaluation of Central Supply Units in Public Dental Medicine Colleges in Brazil

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A guarantee of quality of all steps involved in processing dental materials is essential to achieve security. A descriptive study was made of how Public Dental Medicine Colleges in Brazil process critical materials and determine the patterns of physical, chemical and biological control in their use of hot air ovens and autoclaves to sterilize these materials. The data were obtained with a questionnaire, sent by mail and analyzed with the software EPI-INFO 6.04. Among the 40 Brazilian public Dental Medicine Colleges, only 16 returned the questionnaire. In eight of these, the individuals responsible for the materials and sterilization center had a college degree in a human health field. In 14 institutions, the students were responsible for the cleaning of the instruments, but in six of these they did so outside of the materials and sterilization center. Both the autoclave and the dry heat oven were the method of choice in 13 of the 16 schools. The sterilization routine was routinely monitored by 11 of the institutions. Chemical control through the tape test in the autoclave was used by 13 of the schools, three institutions reported preventive maintenance, and biological indicators were used by seven of the 16 schools. Autoclaves are widely used because of the degree of biological security that this method offers, however physical, chemical and biological controls have not been routinely implemented by most of the institutions.

Key Words: Central supply unit, odontology, quality control.

Proper sterilization of instruments between patients is an essential part of every dental office's infection control program. At the end of the 60s, E.H. Spaulding classified medical devices into three categories as: critical, semi critical and non-critical, depending on the risk of transmitting infection and the need to sterilize them between uses. This classification is accepted by the Centers for Disease Control and Prevention (CDC), the World Health Organization (WHO) and the Health Ministry [1-3].

Critical items are used to penetrate skin, soft tissue, and bone should be sterilized. The articles that come

into contact with oral tissues but do not penetrate them are considered semi critical and high-level disinfection or sterilization is recommended. Non-critical items only come into contact with intact skin. These may be processed with cleaning and low-level disinfection.

The definition of cleaning is the removal of all foreign material (organic material or body fluids) from objects. It is necessary to use gloves and protective eyewear when cleaning instruments to protect against splashing and accidental injury [1]. Disinfection describes a process that eliminates many or all pathogenic microorganisms, with the exception of bacterial spores, from inanimate objects. The chemical disinfectants recommended for materials and instruments include glutaraldehyde, hydrogen peroxide, peracetic acid, sodium hypochlorite, alcohol, iodophors, phenolics and quaternary ammonium compounds. The choice of disinfectant, concentration and exposure time is based

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on the risk of infection associated with the use of the item. Sterilization consists of the complete elimination of the microorganisms. The methods include steam sterilization, ethylene oxide fumigation, and dry-heat [4].

In dentistry, routine procedures require critical, semi-critical and non-critical articles. The American Dental Association –ADA recommended that surgical instruments be sterilized [5]. Dental item sterilization is a vital procedure to reduce the chance of cross-infection in dentistry, and it is recommended for dental instruments due to the difficulty to guarantee that a semi-critical item does not change to a critical one during procedures [6]. The overall process involves basic steps: cleaning, packaging, sterilization, storage and sterilizer monitoring. Sterilization monitoring can be done with biological, physical and chemical indicators.

Physical monitoring consists in observing the sterilization cycle, with preventive maintenance, and the registering of physical parameters (pressure and temperature). Chemical monitoring consists of the use of substances that react when exposed to the parameters necessary for sterilization. It can be parametric [3].

Chemical monitoring involves parameters of time, temperature, and pressure. Single-parameter indicators can be applied to the outside of the package of materials to be sterilized, placed inside the package, or can be part of the packaging; they change color rapidly when a given parameter is reached (e.g., heat-sensitive tape). Single parameter indicators are available for steam, dry heat, and unsaturated chemical vapor. Multiparameter indicators are used in a similar way, but they are only available for steam sterilizers. These indicators measure two or more parameters and therefore provide a higher level of assurance that sterilization parameters have been achieved. Manufacturer's instructions define the use and proper placement of chemical indicators. Indicator test results are received immediately upon completion of the sterilization cycle and they can provide an early indication of a potential problem. If either the internal or external indicator suggests inadequate processing, the item should not be used. Since chemical indicators do not prove that sterilization has been achieved, a

biological indicator (i.e., a spore test) is required to monitoring the sterilization process [7,8].

Biological indicators are the most valid method for monitoring the sterilization process because they assess the sterilization process directly by using the most resistant microorganisms (e.g., *Bacillus stearothermophilus* spores for steam and chemical vapor sterilizers, and *Bacillus subtilis* spores for dry heat sterilizers), and are not merely testing the physical and chemical conditions necessary for sterilization. Because the *Bacillus* species spores used in biological indicators are more resistant and are present in greater numbers than are the common microbial contaminants found on patient care equipment, demonstration that the biological indicator has been inactivated strongly implies that other potential pathogens in the same oven or autoclave load also have been killed [3,9].

Dental items processing should be centralized, for reasons of cost, efficiency, quality maintenance and time monitoring [8].

A crucial problem in the Dental Medicine schools is the difficulty to centralize sterilization procedures, because the instruments belong to the students, and they are responsible for them. This creates difficulties for standardization and supervision of the instrument cleaning and sterilization procedures [10]. The process must be performed properly each time, so that patients and dental office staff are not placed at risk. For the sterilization effort to be successful, it must also be efficient and as benign as possible to the items being treated.

We examined how materials and instruments are processed in Brazilian public Dental Medicine Colleges, and we evaluated the physical, chemical and biological monitoring processes in dry heat ovens and autoclaves.

Material and Methods

A descriptive mailed survey was used to investigate articles processing, in the Central Supply Unit (CSU) in Brazilian public Dental Medicine Colleges. The data were obtained, using a questionnaire, after approval by an ethics committee.

The questions about items processing were validated by three judges (two nurses and one dentist). The Federal Dentistry Committee provided the addresses of all 40 Brazilian public Dental Medicine Colleges. The questionnaire was sent with a stamped return envelope and an informed consent form. Only 16 of the 40 institutions answered and returned the questionnaires. EPI-INFO 6.04 software was used to process the data.

Results and Discussion

Only eight CSUs were run by a health care professional, these being six nurses and two dentists. In the other eight institutions the responsible professional did not have a college degree. The recommendation is that CSU should be run by nurses or other qualified professionals. This result is preoccupying due to the complexity of the steps involved in preparing dental items, which requires adequate training. As these are teaching institutions, they should serve as an example. Tipple [10] indicated that Dental assistants and dental hygiene technicians had inadequate training in the management of CSUs.

Personal protection in the central supply unit

It is mandatory when processing contaminated instruments that heavy-duty utility gloves and other appropriate personal protective barriers (e.g., protective eyewear, gowns, masks, impermeable boots) be worn. Such barriers protect against both potentially infectious materials and hazardous chemicals [7].

Just one institution reported the use of all the recommended personal protection items for the purge section. Students were responsible for cleaning instruments in 14 of the 16 institutions.

The use of private clothes is recommended for those who store the sterilized materials, which should be substituted daily or when dirty [7]. Just one CSU indicated the use of recommended personal protection.

Characterization of the central supply unit

There are three types of CSU: centralized, semi-centralized and decentralized [11]. Ideally, an instrument processing area should be separate from the rest of the office, yet be in a central location. This would allow the CSU to be isolated (physically apart and away from the traffic flow), but within easy transport distance of incoming soiled instruments and outgoing sterile items [3]. By being in a separate room, CSU operations can not be observed by patients, and the chances of accidental exposure are dramatically reduced. Also, sounds, vapors, and odors should be well contained within the CSU [1,7].

Fifteen of the 16 institutions observed this recommendation. However, nine CSUs had passages between the sections. Though they consisted of separate areas, five communicated through doors and four through a window. Most of the institutions followed the recommendations for separate areas in the physical structure, however they maintained transit of materials between the areas through doors and windows.

Eight of the 16 institutions had a specific person for attendance in the CSU, however, in seven the same individual took care of the preparation and storage sections, and one CSU did not answer this question. It is clear that in some cases satisfactory physical structure exists, however the people flow is incorrect. The elaboration of adequate routines for materials and people circulation is necessary.

Ideally, sterile packs should be stored in dry, low-dust, enclosed areas, away from sources of contamination. After instrument processing it is recommended that the articles be stored in closed closets, or on open shelves at least 25cm from the ground, 45 cm from the ceiling and 5 cm from the lateral walls [1,3]. Eleven of the 16 CSUs had open closets and five used closed closets.

The closets should be made of materials, such as metal and formica, which facilitate cleaning and disinfection, without risk of damage by chemical products [7,12]. Seven institutions had metal closets, five used formica, two had wooden closets and two reported concrete closets.

Articles Processing

The cleaning of instruments is an essential step prior to sterilization. This process reduces the number of microorganisms present. It also removes adhering blood, saliva and tissues, as well as dental materials. Residual organic materials can protect microbes, thus jeopardizing the effectiveness of sterilization [13].

In 14 of the 16 institutions, students were responsible for instrument cleaning, in one a technician did this, and in just one the CSU took the responsibility for this stage. In 13 institutions, the students were also responsible for wrapping the instruments. Tipple [10] recommended specific areas for washing and preparing items.

All the necessary sterilization criteria were checked in only eight of the 16 institutions; in three the cleaning, drying and identification were evaluated, however the packaging was not controlled; in two only instrument identification was checked; in two appropriate packaging and readable identification is required, neglecting the observation of cleaning and drying, and in one only the packaging of the instruments was evaluated.

Washing products for cleaning were also investigated. Enzymatic detergents were used by only four of the 16 institutions. These are the most appropriate, because they are composed of enzymes, surfactants and solvents [7]. The use of neutral soap was reported by six institutions, common soap by four, and one used household cleansers, demonstrating that household products are still used in cleaning dental instruments. One institution reported the use of chlorhexidine as soap for cleaning material, however this product is an antiseptic and does not have cleansing properties [14,15].

The towels for instrumental drying should be absorbent and should not leave residues [12]. Drying instruments by hand, using toweling material, should be avoided. Nine of the 16 institutions indicated use of fabric towels and/or compresses. All the institutions were responsible for the sterilization of the instruments, using different methods.

All the various methods are considered to provide sterilization, however autoclaves offered the greatest

safety margin and were cheapest to run, followed by dry heat and chemical sterilization. The choice depends on the nature of the article to be sterilized [3,16].

After cleaning and drying, instruments should be wrapped for sterilization. The packing depends on the sterilization method [17]. All the institutions attended the sterilization recommendations for autoclaves. The packaging used in the autoclave was: raw cotton (n = 8), kraft paper (n = 7), surgical quality paper (n = 5); six used baskets, trays and boxes and one did not use fabric. The use of several types of involucres in the same institution was observed.

Metallic boxes were used by 11 of the 13 institutions that used dry heat sterilization. The metallic box is the appropriate packing for this method [3,16]. Two CSUs indicated that they used kraft paper in dry heat ovens, which is considered inadequate [3,18]. Among the 16 institutions, seven used an autoclave and 13 also used dry heat. The parameters time and exhibition temperature are very important to guarantee the sterilization process.

All the institutions indicated the use of thermometers to monitor the dry heat temperature, based on the recommendations of the Health Ministry. The time temperature relations in table 3 show a lack of standardization. The recommended temperature is 170°C for one hour, which was observed for only six of the 16 CSUs [3,16]. Dry heat is still common in dentistry practice, however it is difficult to guarantee quality with this method [19].

Autoclave sterilization is the safest and most effective method, with recommended temperatures of from 121°C to 132°C [16,17]. The exposure time ranges from 15 to 30 minutes, depending on the material [11].

Physical monitoring checks and registers critical parameters of the sterilization process [7]. Only three of the 16 CSUs had dry heat and autoclaves maintenance monthly, following recommendations. Repair maintenance of the equipment prevailed. Eleven of the 16 institutions had a routine for the registration of the cycles of the dry heat ovens and autoclaves.

The use of a specific chemical strip indicator is recommended for each sterilization method [7,8]. Most (13 of 16) of the institutions indicated the use of the

Table 1. Criteria for reception of contaminated material to give to the Central Supply Unit in Brazilian public Dental Medicine Colleges

| Criteria | No. |
|--|------------|
| Cleaning, drying, packaging and identification | 8 |
| Cleaning, drying and identification | 3 |
| Identification | 2 |
| Packaging and identification | 2 |
| Packaging | 1 |
| Total | 16 |

Table 2. Towel type adopted for drying instruments in Brazilian public Dental Medicine Colleges

| Type of towels | No. |
|---|------------|
| Towels of fabric and/or compresses of daily use | 9 |
| Fabric towels / paper towels | 3 |
| Paper towels | 3 |
| No answer | 1 |
| Total | 16 |

Table 3. Relationship between time and exposure temperature for sterilization in dry heat in Brazilian public Dental Medicine Colleges

| Temperature/time | No. |
|-------------------------|------------|
| 170°C - one hour | 6 |
| 170°C - two hours | 6 |
| 160°C - 1.5 hours | 2 |
| 180°C - 45 min | 1 |
| Did not answer | 1 |
| Total | 16 |

Table 4. Time and exhibition temperature for sterilization in autoclaves in Brazilian public Dental Medicine Colleges

| Temperature/time | No. |
|-------------------------|------------|
| 121°C - 30 min | 6 |
| 122°C-135°C - 30 min | 3 |
| 122° C - 135°C - 15 min | 2 |
| 122°C - 135°C - 1 hour | 2 |
| No answer | 3 |
| Total | 16 |

Figure 1. Detergents used for washing instruments in Brazilian public Dental Medicine Colleges

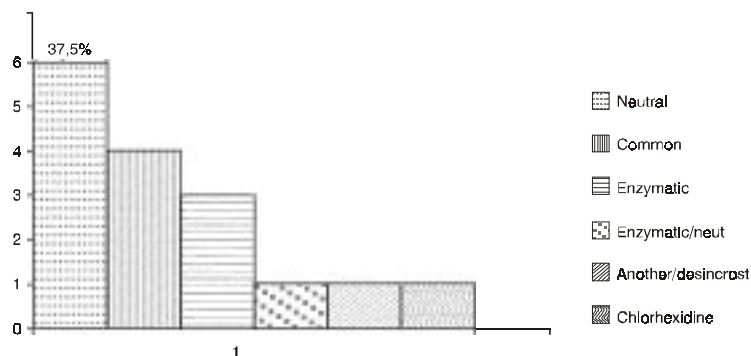


Figure 2. Sterilization methods for processing articles in Brazilian public Dental Medicine Colleges

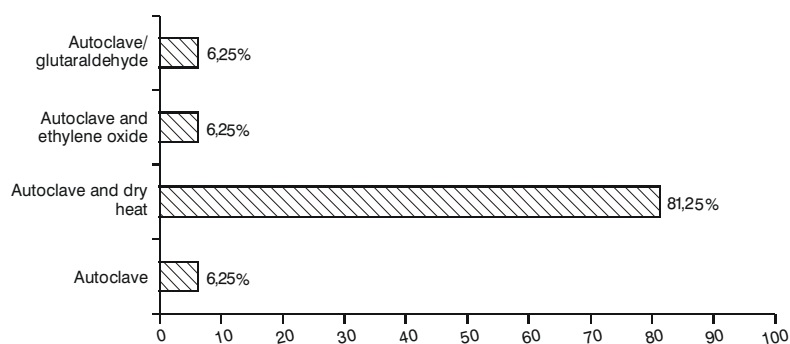


Figure 3. Dry heat sterilization maintenance routines in Brazilian public Dental

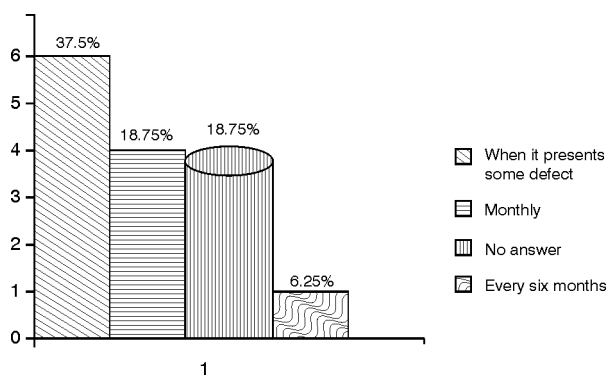
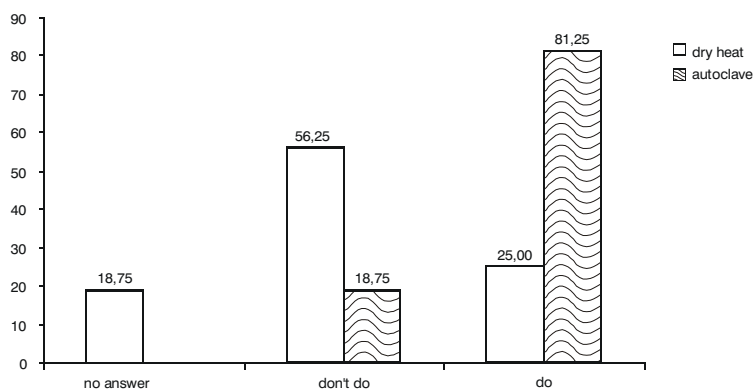
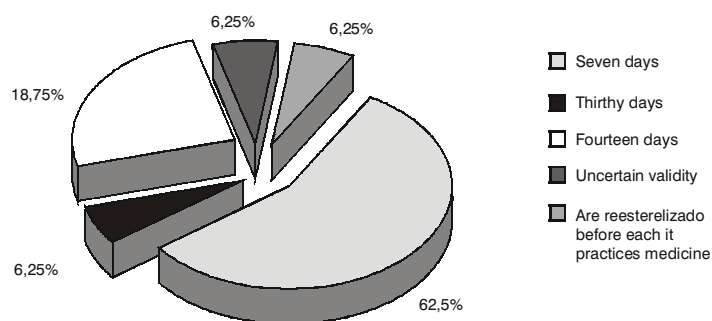


Figure 4. Routine of chemical test strips in autoclave and dry heat in Brazilian public Dental Medicine Colleges**Figure 5.** Validity periods of instruments after sterilization in Brazilian public Dental Medicine Colleges

test strip for the sterilization processes in autoclaves and also for dry heat (7 of 13). Only one CSU used biological indicators.

Items processed in all of the various types of heat sterilizers are hot when they are ready to be removed. Hot items should be allowed to cool slowly [7]. Exposure of hot items to cold air (e.g., from an air vent or a window) should be prevented to avoid forming condensation [20]. Just one CSU manipulated the items after they were cold. In their handling of autoclaved material, nine institutions discharged the material cold, in agreement with the recommendations, three discharged very hot material, in three the material was still hot, and one CSU did not answer.

The shelf-life time depended on the wrap and the place used to store the material [3,16].

The CSUs did not adopted a specific stored preiod. However, one CSU considered an uncertain time for sterilized articles. One institution sterilized the material again before each ambulatory, independent of the date of the last sterilization. This is an unnecessary procedure, which could damage the articles.

Conclusions

The analysis of 16 public Dental Medicine Colleges in Brazil showed that the institutions had separated processing and storage areas, but in 13 of 16 there is communication among the sections. Fifteen of 16 CSUs were semi-centralized, and in 14 the students were responsible for cleaning and drying the instruments.

In 50% of the institutions, the CSU was run by a professional with less than college education.

The use of personal protection barriers was incomplete in most institutions, revealing a lack of standardization and biosafety.

Though there are solutions designed for cleaning instruments, washing of the instruments was done with domestic or neutral detergents in 10 of the 16 schools.

Procedures for processing instruments through the two main types of heat sterilizers (autoclaves and dry heat oven) were presented by 13 of the 16 CSUs.

Because sterilization failure can occur at any time, it is imperative that dental office sterilizers be properly operated, correctly maintained, and regularly monitored. Preventive maintenance of dry heat ovens and autoclaves was done by only three of the institutions. The test strip for dry heat was not routinely by most of the institutions, and biological monitoring was neglected in 11 institutions for dry heat and in seven institutions for autoclaves.

Most institutions did not adopt physical, chemical and biological quality controls, evidencing fragility in their routines for processing critical articles in dry heat and autoclaves. There are deficiencies in the physical structure of the CSUs, as well as negligence in the use of personal protection equipment.

Brazilian Dental Medicine Colleges need to assure the quality of sterilization processes. Processing instruments and materials used in dentistry requires an adequately trained professional and a conscientious effort towards infection control (TIPPLE, 2000). In spite of the difficulties in finding qualified personnel and lack of material and money, it is still believed that the standardization of routines seeking a guarantee of quality is fundamental and possible in CSUs.

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