

*Full Length Research Paper*

# Hygiene and sterilization of endodontic and surgical equipment at the Municipal Oral Health Center of Ouagadougou

Wendpoulomdé A. D. Kaboré<sup>1,2\*</sup>, Carole D. W. Ouédraogo<sup>2</sup>, Abdoulaziz Diarra<sup>2</sup>, Diouma Ndiaye<sup>3</sup>, Rasmata G. Traoré<sup>2</sup>, Raoul Bationo<sup>2</sup>, Tarcissus Konsem<sup>1</sup> and Babacar Faye<sup>3</sup>

<sup>1</sup>Department of Health (UFR/SDS), Pr Joseph Ki Zerbo Ouaga I University 03 P. O. Box 7021 Ouagadougou 03, Burkina Faso.

<sup>2</sup>Municipal Center of Oral Health of Ouagadougou (CMSBD), 01 P. O. Box 85 Ouagadougou 01, Burkina Faso.

<sup>3</sup>Conservative Dentistry and Endodontics Department, Cheikh Anta Diop University - Dakar, P. O. Box 5005 Dakar-Fann, Senegal.

Received 11 May, 2016; Accepted 20 June, 2016

Daily oral endodontic and surgical care requires careful management of infection risks to prevent both patient and medical staff from nosocomial infection by cross-contamination. The purpose of this study is to review the sterilization process of endodontic and surgical equipment at the Municipal Center of Oral Health (CMSBD) of Ouagadougou. This is a cross-sectional study carried out during January 2016. Data were collected from the staff responsible for the sterilization of endodontic and surgical equipment and the head of the aseptic chain. Various steps of the aseptic chain at CMSBD were generally complied with. However, weaknesses in the system include packaging and sterilization of rotary equipment. Though, sterilization rules at CMSBD were satisfactory, they should be further strengthened. Quality check-ups are necessary regarding the importance of the field.

**Key words:** Hygiene, sterilization, endodontic, surgical equipment.

## INTRODUCTION

Sterilization is a set of hygiene measures used to prevent both patient and medical staff from nosocomial infection by cross-contamination (Ferrec, 2007). It obviously includes all dental equipment, especially surgical and endodontic instruments. Since they go through the mucosal barrier and are contaminated by organic liquids, notably, saliva and blood. The main micro-organisms that could be inoculated to patients through poor sterilization

are bacteria, viruses, and prions (Ferrec, 2007). In developed countries, the resources for infection prevention and control are available and freely available, which is not the case in developing countries (Oosthuysen et al., 2014). In Burkina Faso, attendance rate in most public oral health facilities is beyond their capacity (Kaboré et al., 2015).

Management of infection risks is mandatory in all health

\*Corresponding author. E-mail: [dr\\_kabore@yahoo.fr](mailto:dr_kabore@yahoo.fr). Tel: +22670211283.

disciplines. This implies a good command of aseptic rules to avoid any external contamination of micro-organisms (Bagui et al., 2014). Many studies have demonstrated the persistence of protein remnants on surgical instruments that are manually cleaned with detergents or ultra-sonic baths.

Such instruments are likely to cause cross-infections (Smith et al., 2011). Files and other endodontic instruments were particularly investigated because they come into contact with the abundantly innervated dental pulp, considered as a potential source of infections. In addition to the risk of cross-infection related to the persistence of protein remnants, these very complicated structural instruments are often distorted during treatment and later when they are cleaned and sterilized (Gourieux et al., 2010).

When the staff is overworked, less attention is paid to some aspects of the treatment, especially infections prevention. Studies in developing countries also indicate serious shortcomings with regard to infection prevention (Oosthuysen et al., 2014). This study was undertaken to review how the sterilization process of endodontic and surgical equipment at the Municipal Center of Oral Health (CMSBD) of Ouagadougou, regarding the recommendations of the Guide for preventing dental surgery and stomatology care-related infections (GPICDS, 2006).

## MATERIALS AND METHODS

### Site, time and type of study

This is a cross-cutting sectional study carried out in during January 2016 at the Municipal Center of Oral Health of Ouagadougou. The sterilization ward had 8 soaking trays with covers placed on three benches near three water sinks, with one autoclave, one poupinel, one welding machine, and two ultra-sound trays were also placed on shelves. Two cupboards, including one for endodontics and surgery, were used for storage.

### Data collection

Data were collected on a daily basis following the sterilization cycle of the endodontic and surgical equipment for one month (January, 2016). Seven variables including pre-disinfection, washing, packaging, sterilization, storage, the specific case of rotary instruments, and environmental infections check-up were assessed. The data was collected by filling a daily form when these steps are performed, according to the recommendations of the Guide for preventing dental surgery and stomatology care-related infections (GPICDS, 2006).

A health officer was responsible for the sterilization department and supervised on a day-to-day basis. Four ward assistants were in charge of sterilizing dental equipment. One of them was particularly trained for the sterilization of endodontic and dental implant surgery equipment. Data were collected from this ward assistant and the head of department by a dental surgeon. None of them was informed on the service evaluation.

This study was approved by the administrative and health authorities of the Municipality of Ouagadougou.

## RESULTS

### Pre-disinfection

At CMSBD, pre-disinfection was made by soaking instruments in a 5% Micro 10® solution (Unident, Suisse). This bactericidal, yeasticidal, virucidal solution mainly made up of alkylamine and alkyldimethylethylammoniummethyl sulfate, certified VAH/DGHM (VAH, 2014) is used to disinfect instruments and drills. The solution was changed every 4 days or as soon as it was saturated with remnants or biomedical debris. Soaking took at least 20 min. Surgical equipment was soaked in different trays to avoid congestion and allow instruments to lie efficiently under water. Forceps, elevators, syringes, retractors, clamps carriers and scrapers were soaked in separate trays, and were put 20 min later in the washing tray. Drills and endodontic instruments (files K, files H, wipers, forests, stuffing-paste, endodontic burs, Protaper files, clamps,) were disinfected in a dedicated container, leading to a homogeneous load.

### Washing-rinsing-drying

Clean medical equipment is obtained following this step. CMSBD has no automatic cleaning system. The entire washing process was manual. It was done with a soft brush, a sponge or a metallic carding brush in a tray containing soapy water. The medical agent wore rubber gloves. Articulated instruments were dismantled for efficient washing. Then, they were abundantly rinsed in a second tray, wiped, and dried up with a clean towel. Instruments dried in this way were then laid on a towel on the bench.

### Packaging

Packaging aims to protect clean equipment prior to sterilization and keep it aseptic after sterilization. Equipment was packaged immediately after cleaning. At CMSBD, there are two types of packaging including single-use packaging (with rubber bags) and multiple-use packaging (containers or trays). Single-use packaging was performed only for oral surgery, surgical implant dentistry, and endodontics and for patients with high infection risk.

### Sterilization

Two types of sterilization processes are performed by the sterilization department, including dry heat (Poupinel) and wet heat sterilization (Autoclave). Endodontic and surgical instruments were 3-Bar autoclave sterilized for 30 min at 143 Celsius degrees as required by the

manufacturer.

### Storage

Sterilized equipment was stored in a metallic cupboard and carried in two carts with drawers in endodontics and surgery wards.

### Rotary instruments

Rotary instruments were not sterilized. Instead, they were cleaned with EuroSept® Max disinfection wipes (Henry Schein, USA) according to AFNOR standards (AFNOR, 2015). These are aldehyde free wipes for rapid disinfection of dental surfaces and units. These bactericidal, virucidal, and yeasticidal wipes were used whenever a patient is admitted. Mikrozid® AF wipes (Schülke, Germany) were also used. In case of stock-out, a Micro 10 swab was used. Rotary instruments were lubricated at the end of each work day.

### Environmental infection control

This includes two main sections namely the management of contaminated surfaces as well as the manipulation and disposal of medical waste. Every evening, floors, sinks and other surfaces were cleaned with soapy bleached water by a hygiene team. Their work consisted in emptying bins that are taken out for incineration. There were 2 types of bins in each room. A bin with a rubber bag for non-cutting biomedical waste (compresses, tissue debris, etc.) and a cardboard bin for cutting biomedical waste (needles, lancets, etc.). On a quarterly basis, the team would clean windows and curtains when they are dirty or dusty. Nevertheless, every morning before treatment begins, all benches and solid surfaces into which the dentist come in contact were disinfected with a bleached solution. They were automatically decontaminated when visibly soiled. Blood stains and other biological substances were cleaned with alcohol spray or pure bleach. In case of oral or dentistry implant or endodontic surgery, all immediate surfaces likely to be contaminated were disinfected and covered with a sterilized cloth. Dentasept SH® solution (Anios, France) was also used to clean and disinfect medical devices.

### Dental units water pipes and suction systems

A filter was placed for each dental chair for drinking water supply. A sanitation system allowed water to go through a jar leading to the chair lines. Suction systems were disinfected every day with Cattani Magnolia® pastille (Cattani, Italy), known for its non-foaming, bactericidal,

and yeasticidal properties (DNVBAMSC, 2015). Dentasept Aspiration® solution (Anios, France) was also used, in the absence of which Micro 10® 5% diluted solution was used.

### Hygiene and hands washing

Oral or endodontic surgery requires a 5-minute surgical hand washing using sterilized towels and antiseptic soap dispenser available on shelves. For common surgery at CMSBD, practitioners would invariably practice either a simple or antiseptic hands washing between each patient. EuroSept® hand disinfectant alcohol (Henry Schein, USA) was used as prescribed by EN 1500 (AFNOR, 2013) and EN 1484885 (AFNOR, 2015) standards.

### DISCUSSION

This study was limited to CMSBD. Although it shows weaknesses, its been useful in reviewing the issues around sterilization of endodontic and surgery equipment in a context of strong clinical activity. Preventing risks of infection during oral treatment implies the implementation of appropriate hygiene measures to protect the dentist, the assistant, and patients (Gourieux et al., 2010). Management of infection risks is essential for any successful surgical or endodontic treatment. The practitioner should ensure that all sterilization and ergonomics principles are strictly observed before, during and after surgery. These principles mainly relate to the sterilization chain for all instruments and tools that can be re-used, surgery ward organization, patient and surgical team preparation as well as, ergonomics, controlled gesture during surgery, and finally waste disposal, and premises maintenance (Bagui et al., 2014). Pre-disinfection as performed at CMSBD seemed in line with the recommendations set forth in the Guide for preventing dental surgery and stomatology care-related infections (GPICDS, 2006).

However, as far as hand washing was concerned, staff was exposed to a high contamination risk (e.g. by cutting) and indoor air pollution caused by nebulization due to brushing, even though no measures were taken to prevent this risk. Manual washing is generally done for some hollow instruments requiring a swab. CMSBD has no machine for automatic washing and staff is not provided with glasses, work clothes, and masks.

According to a study by Ferrec (2007), poupinels should be prohibited because they are totally inactive on prions. Yet, dry heat sterilization was still largely practiced at CMSBD even though surgical and endodontic instruments were carefully autoclave sterilized. The French Guidelines for preventing infections in odontological and stomatological wards recommends brush

and metallic card sterilization instead of using sponges. Unfortunately, in this study, neither brushes nor metallic cards were sterilized. Furthermore, sponges (not recommended) were also used for washing. An efficient sterilization heavily depends on the appropriate implementation of previous steps which were generally followed at CMSBD. The autoclave volume was respected. Neither rubber bags nor boxes were piled up. An 18-minute sterilization at 134°C is recommended for prions (Gourieux et al., 2010). Prion diseases or transmissible sub-acute spongiform encephalopathies (ESST) are fatal neurodegenerative diseases (Gourieux et al., 2010). Some studies have revealed a small amount of prion in dental tissues (Okada, 2010). These results show that protein prion can spread into the nerves from the trigeminal ganglion. Oral tissues must therefore be considered as a potential source of horizontal transmission (Okada, 2010). Sterilization cycle was respected at CMSBD. On the other hand, monitoring sterilization efficiency is not guaranteed. Adequate monitoring of this process requires mechanical, technical, chemical and biological indicators such as spore testing. Though biological monitoring is helpful in ascertaining the efficiency of sterilization equipment and processes, mechanical and chemical monitoring can reveal the leading signs of a defective sterilizer (Ferrec, 2007). Sterilized equipment must be kept in a dry clean room. Two rooms are therefore recommended: One for cleaning and disinfection and the other one for packaging, sterilization, and storage. This was not the case at CMSBD, however, the go-forward principle, from the dirtiest to the cleanest, was respected. Storing was not so difficult because sterilized instruments were used right away the following day. Up to now, there is no sterilization dating system to prevent sterilized instruments from expiring.

Due to the internal complicated structure of rotary instruments, they cannot be dismantled for sterilization even though they are stained by blood, saliva, or organic debris that is carried deep inside the various parts (Ferrec, 2007). Therefore, it is essential to sterilize them. Today, disinfecting devices that automatically lubricate and even sterilize rotary instruments do exist. Studies report cases of air contamination in the office due to rotary instruments (Messano, 2013). Indeed, staphylococcus was found in high speed rotary instruments during dental treatment (Kimmerle, 2012). It is necessary to have several rotary instruments because using a disinfecting wipe between two patients is not safe. Unfortunately, CMSBD had no self-washing equipment or sterilizers for rotary instruments. Rotary instruments were superficially disinfected and lubricated. Weaknesses in the sterilization process at CMSBD include dental turbines, contra-angles, handpieces, and container packaging. With the heavy work load due to high attendance rates in the center, instruments were found unwrapped in drawers. Manipulation of these drawers could cause re-contamination which is

detrimental to asepsis. This also applies for endodontic instruments and drills. It is better to prioritize plastic packaging for each patient in order to minimize manipulation. However, this requires finances. An exploratory study to determine the current infection control practices and assess the perceived compliance and challenges with infection control standards guidelines was performed in Massachusetts public dental health programs. This study reported that public dental health program directors in Massachusetts perceived that lapses in the guidelines were attributed to poor financing and poor staff as well as lack of space. Therefore, they indicated that CDC guidelines were hard to apply (November-Rider et al., 2012). As far as environmental infection control is concerned, the recommendation contained in the Guide for preventing dental surgery and stomatology care-related infections was well enforced at CMSBD. Studies highlighted the importance of environmental contamination by bacteria such as *Staphylococcus aureus* (Petti, 2014). This bacterium was found in the context of dental care, while contamination seems to be handborne (Petti, 2012). NHS Lanarkshire (2015) recommends that all surfaces likely to be contaminated during surgery be disinfected after one single patient. Operation lights, dental chair, and control buttons must be protected by sterilized covers and replaced after one single patient. This process is performed at CMSBD during surgical care. Regarding routine surgery including simple tooth extraction and pulpectomy, all surfaces, vacuum cleaners, and pipes which do not seem to be contaminated were cleaned after every single patient.

The inside surface of dental water pipes supplied through the town drinking water system is infested with micro-organisms.

Bacteria, yeasts, and protozoan live in a polysaccharide bio-film layer that protects and feeds them (Bebermeyer et al., 2005). Even though bio-film is formed in water-logged environments, thin water pipes and water from dental units favour the growth of bacteria and the bio-film. At CMSBD a filter was placed before connecting the dental chair to the waterpipe. The risk of infectious disease transmission is inherent to dental practice. Fortunately, such risks can be significantly reduced through modern infection control practices, which include the use of various measures such as administrative, engineering, and work practice controls. Such measures should be codified in an office infection control plan, which should be the basis for the staff daily infection control activities (Thomas et al., 2008).

## Conclusion

Sterilization in endodontics and surgery must be considered by practitioners with the utmost importance. Although this study has demonstrated a quite good command of the chain of asepsis at CMSBD, there is

urgent need for improvements. Instead of going for single-use instruments, priority should be given to plastic packaging for each patient.

### Conflict of Interests

The authors have not declared any conflict of interests.

### REFERENCES

- Agence Française de Normalisation (AFNOR) (2015). Antiseptiques et désinfectants chimiques, Application des Normes européennes sur les antiseptiques et désinfectants chimiques. pp. 1-63.
- Agence Française de Normalisation (AFNOR) (2013). Antiseptiques et désinfectants chimiques, Traitement hygiénique de mains par frictions - Méthode d'essai et prescriptions (phase 2/étape 2). pp. 1-35.
- Bagui M, Fajri L, El Mohtarim B, Merzouk N (2014). La gestion du risque infectieux en implantologie. *Actualités Odonto-Stomat.* 269:28-33.
- Bebermeyer RD, Dickinson SK, Thomas LP (2005). Guidelines for Infection Control in Dental Health Care Settings-a review. *Text Dent. J.* 122(10):1022-1026.
- DNVBAMSC (DNV Business Assurance Management System Certificate) (2015). Design Manufacturing repair of aspiration and compressed air distribution system for odontoiatric application UNI EN ISO 9001.
- Ferrec G (2007). Stérilisation du matériel de chirurgie au cabinet dentaire. *Actualités Odonto-Stomat.* 237:61-81.
- Gourieux B, Lemoine S, Bornert F, Parmier M, Perisse J, Tranchant C, Feki A (2010). Risque de transmission des prions lors de la prise en charge d'un patient suspect de maladie de Creutzfeldt-Jakob sporadique. *Med. Buccale Chir Buccale.* 16:217-226.
- GPICDS (2006). Guide de prévention des infections liées aux soins réalisés en chirurgie dentaire et stomatologie (Ministère de la santé et des solidarités, DGS, France) 2<sup>ème</sup> édition. pp. 1-72.
- Kimmerle H, Wiedmann-Al-Ahmad M, Pelz K, Wittmer A, Hellwig E, AlAhmad A (2012). Airborne microbes in different dental environments in comparison to a public area. *Arch. Oral Biol.* 57:689-696.
- Messano GA, Sofan AAA, Petti S (2013). Quality of air and water in dental healthcare settings during professional tooth cleaning. *Acta Stomatol. Naissi.* 29:1230-1235.
- Lanarkshire NHS (2015). Area Control of Communicable Disease Committee/Infection Control Committee (2015). Guidelines for the Control of Infection in the Dental Surgery and Decontamination Room (GCIDSD). pp. 1-52.
- Oosthuysen J, Potgieter E, Fossey A (2014). Compliance with infection prevention and control in oral health-care facilities: a global perspective. *Int. Dent J.* 64(6):297-311.
- Kaboré WAD, Garé JV, Niang SO, Guiguimé PWL, Ouédraogo Y, Rodriguez I (2015). L'offre Bucco-Dentaire De Soins En Milieu Urbain Au Burkina Faso : Exemple De La Ville De Ouagadougou. *Rev. Iv. Odonto-Stomatol.* 17(2):42-49.
- Okada H, Sakurai M, Yokoyama T, Mohri S (2010). Disease – associated prion protein in the dental tissue of mice infected with scrapie. *J. Comparative Pathol.* 143:218-22.
- Petti S, Bossù M, Messano GA, Protano C, Polimeni A (2014). High salivary Staphylococcus aureus carriage rate among healthy paedodontic patients. *New Microbiol.* 37:91-96.
- Petti S, Polimeni A (2012). Methicillin-resistant-Staphylococcus aureus infection transmission in dental health care settings: myths and facts. *Am. J. Infect. Control.* 40:287-288.
- Smith GWG, Goldie F, Long S, Lappin DF, Ramage G, Smith AJ (2011). Quantitative analysis of residual protein contamination of podiatry instruments reprocessed through local and central decontamination units. *J. Foot Ankle Res. J. Foot Ankle Res.* 4:2.
- Thomas MV, Jarboe G, Frazer RQ (2008). Infection control in the dental office. *Dent Clin. North Am.* 52(3):609-628.
- VAH Verbun fur Angewandete Hygiene (2014). Desinfektionmittel-KommissionimVAH. Certificate for conformity of efficacy tests for DC1.