



Biological indicators: the gold standard to verify the sterilization steam in dentistry

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ABSTRACT

Infection control in dental practice is a daily necessity, the correct way to ensure safe environments is to disinfect medical equipment and sterilize materials and instruments. There are common failures in sterilization cycles in dental offices, caused by various factors, mainly a mechanical failure, and human error. Biological indicators are prepared from thermo-resistant bacterial spores, used to determine the quality of the sterilization processes. There are different types of indicators on the market, however, it is necessary to promote and publicize the use of biological indicators as means of verification of the sterilization process, since their use is not frequent as indicated in the NOM-013-SSA2-2015, which must be every two months.

Keywords: Biological indicators, sterilization, verify, Dentistry, Mexico.

Indicadores biológicos: el estándar de oro para verificar la esterilización por vapor en odontología

RESUMEN

El control de las infecciones en la práctica Odontológica es una necesidad diaria, la forma correcta de asegurar ambientes inocuos son la desinfección de los equipos médicos y la esterilización de los materiales e instrumental. Comúnmente existen fallas en los ciclos de esterilización en consultorios dentales, causadas por diversos factores, principalmente fallos mecánicos y errores humanos. Los indicadores biológicos son preparados de esporas bacterianas termo-resistentes, usados para determinar la calidad de los procesos de esterilización. Existen en el mercado diferentes tipos de indicadores, sin embargo, es necesario promover y dar a conocer el uso

de los indicadores biológicos como medios de verificación del proceso de esterilización, debido a que su uso no es frecuente como lo indica la Norma Oficial Mexicana 013-SSA2-2015, el cual debe ser cada dos meses.

Palabras clave: Indicadores biológicos, esterilización, verificación, odontología, México.

INTRODUCTION

Odontology is a health science that consists of the improvement, prevention, and maintenance of the health of the stomatognathic system. This discipline must comply with regulations to maintain the hygiene of instruments and equipment to avoid contamination between patients since dental activities are carried out in environments highly contaminated by microorganisms. A drop of saliva can contain approximately six hundred thousand bacteria, the oral cavity provides characteristics that promote growth and proliferation. Infection control has become a critical part of dentistry.¹⁻⁴

Infections can be transmitted from person to person in the following ways:

- Direct route: the infectious agent goes from the infected person to the susceptible person directly, without any vehicle. This is the most common form of transmission and can be by coughing, sneezing, or speaking, when body fluids come in contact with ocular, nasal, oral, or dermal tissues.
- Indirect route: the infectious agent goes from the infected person to the susceptible person through a transmission vehicle, usually an inanimate intermediate object contaminated with microorganisms. For example, gloves that do not change between patient and patient, dental instruments, contaminated water, and surfaces of dental equipment.
- Transmission route by air: it is the microbial spread suspended in the air and inhaled by the respiratory way.^{5,6}

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Dental environments have work areas where activities present physical, chemical, and biological risks for patients and professionals who work there, which makes possible the incidence of cross infections. Infection prevention should focus on effective sterilization of medical materials, tools, and equipment and the right decontamination process that includes cleaning, disinfection and, use of protective barriers.⁷ According to the previous context, who practices dentistry must adhere to standards the regulations for infection control within the dental clinic, preserving their safety, auxiliary staff, patients, and families.⁸

METHODS TO MONITOR THE EFFECTIVENESS OF STERILIZATION

Sterilization is the procedure responsible for the destruction of all forms of microbial life. Any instrument that has been in contact with the oral cavity after use must be adequately sanitized, removing existing remains with plenty of soap and water, before introduced into the sterilizer or autoclave.

Dentists must understand that sterilization techniques can be fallible and often fail.^{9,10} The factors involved in the failure of the sterilization process are overload and mechanical defects, mainly. Many factors can influence a sterilization cycle to efficiently produce a package of sterile material, for example, steam penetration, drying time, and device settings (time, temperature, and pressure).^{1,6,7} Because various factors directly influence the success of sterilization processes, and to guarantee their reliability, international organizations recommend monitoring these processes at least monthly or weekly and when equipment repair, or new staff are trained.^{11,12}

Methods to monitor the effectiveness of sterilization may include physical indicators, chemical indicators, and biological indicators (BI). The resistance of microorganisms to sterilization ranges varies according to many factors, the most resistant are bacterial spores, which is why they are used for monitoring sterilization processes as biological indicators.¹²

BIOLOGICAL INDICATORS

The BI are liquid preparations or paper strips with a sufficient load of spores high resistance to sterilization. The use of BI is considered the most significant technique to verify sterilization cycles, because measures the destruction of highly resistant bacterial spores (lethality), if spores are destroyed, it can be assumed that all other microorganisms in dental instruments are also eliminated.¹⁻⁷

Compliance with specific regulations and standards is very important to control and reduction of epidemiological risks. In the USA, ADA (American Dental Association), OSAP (Organization for Asepsis Safety and Prevention) and CDC (Centers for Disease Control and Prevention) recommend using weekly.¹⁻²²

In Mexico, the NOM-013-SSA2-2015 to Prevention and Control of Oral Diseases has developed guidelines with the purpose to reduce the risk of disease transmission (patient-dentist or dentist-patient) and establishes the use of every two months BI for control of sterilization cycles.²³ The norm says: «All sterilization techniques are fallible, apply biological controls every two months, as a quality control of the sterilization cycles and keep a record of the results, according to the Pharmacopoeia of the United Mexican States», comply with this standard is mandatory since it is published in the Official Newspaper of the Federation.¹⁻²²

Studies realized in different countries indicate an inappropriate knowledge and inadequate praxis on infection control in dental practice.²⁴ It is necessary to increase the importance of routine maintenance/calibration of autoclave and monitoring the efficacy of sterilization process with BI to avoid transmission of multiple infections.

A study realized in Tabriz, Iran (2011);²⁵ showed the use of BI in hospitals in 1997 was 0%, with reinforcement for use in 2011 proportion hospitals that used chemical indicators reached 100%, and BI reached 68% (25). Patiño,¹⁵ a study realized in S.L.P, Mexico revealed of 230 verified sterilizers, 62 autoclaves, and 168 dry heat ovens, only 36% (22) of dentists with autoclaves and 17% (28) with dry heat use BI having a frequency of sterilization cycles once a day. It was identified 206 professionals who participated, only 22% (45) knew and used BI; consequently, 78% (161) had not performed corresponding quality control. Jihad Dagher, in Beirut, Lebanon with a sample of 134 autoclaves and 71 dry heat ovens, found few dental practices reported having preventive maintenance (17.9% for the autoclaves and 14.1% for the ovens). Routine monitoring of sterilizer efficacy was infrequently performed and was mostly conducted using physical indicators. The sterilization failure rate was higher for the ovens (16.9%) than for the autoclaves (7.5%), which identified the human error in setting sterilization cycle parameters as the predominant cause of failure.²⁶

CONCLUSION

In recent years, the appearance of new infectious contagious diseases such as COVID-19, in addition

to thermo-resistant microorganisms found in the environment, increases interest in a quality health service and greater occupational protection, it is necessary to review and update procedures for the control of pathogenic microorganisms. Information is deficient on the use of BI to verify the quality of sterilization procedures, it is a current problem in Mexico because dentists do not routinely practice this type of control, even though its use is recommended by government health control regulations. It is also evident the lack of control by the health authorities that evaluated the risk of transmission of pathogen infections in the dental environment based on the official norm. Collaborative actions should be joined between health authorities, dental schools, and associations to propose and implement biological monitoring protocols mainly in developing countries.

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