

USE AND MANAGEMENT OF DISINFECTANTS BY DENTISTS IN SAN LUIS POTOSI, MEXICO, DURING THE COVID-19 PANDEMIC.

Uso y manejo de desinfectantes por odontólogos de San Luis Potosí, México durante la pandemia Covid-19.

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ABSTRACT:

Introduction: Chlorine, ethyl alcohol, and quaternary ammonium are disinfectants with antiviral activity against SARS-Cov2. However, there are no previous reports of their use and handling for cleaning and disinfection in dental offices.

Objective: To determine the use and management of disinfectants in critical and non-critical areas used by dentists in San Luis Potosí, Mexico, during the COVID-19 pandemic.

Material and Methods: A validated cross-sectional survey was applied online to 100 dentists in San Luis Potosí between February and June 2021. Participants were informed about the handling of personal data according to the standard DOF regulations (DOF 07-05-2010).

Results: A total of 100 dentists were included in the study, 63% female and 37% male, with a mean age of 26 years. The most widely used disinfectants during the pandemic in critical areas were Lysol® and 0.1% sodium hypochlorite in non-critical areas. Eighty-five percent of dentists know the adverse effects of inappropriate use of disinfectants, 72% did not have any sign or symptom associated with the use of disinfectants. The most used protection barrier was gloves (97%). Sixty-seven per cent of dentists disposed of disinfectant waste down the drain.

Conclusion: Sodium hypochlorite and quaternary ammonium compounds and/or ethanol are used to clean non-critical and critical areas in dental offices. However, appropriate measures for their management are not adopted. It is necessary to implement educational strategies to improve the use and management of disinfectants in dental practice.

KEYWORDS:

Dental offices; Disinfectants; Dentists; Pandemics; Disinfection; Cross-sectional studies.

RESUMEN:

Introducción: Cloro, alcohol etílico y amonio cuaternario son desinfectantes que muestran actividad antiviral contra el SARS-Cov2, sin embargo, no existen reportes previos de su uso y manejo para la limpieza y desinfección en clínicas dentales.

Objetivo: Determinar el uso y manejo de los desinfectantes en áreas críticas y no críticas empleados por los odontólogos en San Luis Potosí durante la COVID-19.

Material y Métodos: Encuesta transversal validada y aplicada on-line a 100 odontólogos de San Luis Potosí durante febrero-junio 2021. Se informó a los participantes sobre el manejo de datos personales de acuerdo a la norma (DOF 05-07-2010).

Resultados: Se incluyeron un total de 100 odontólogos, 63% del sexo femenino y 37% del sexo masculino, con una edad promedio de 26 años. Los desinfectantes más utilizados durante la pandemia en las áreas críticas fueron el Lysol®

y el hipoclorito de sodio al 0.1% en áreas no críticas. El 85% de los odontólogos conocen los efectos adversos del uso inadecuado de los desinfectantes, 72% no tuvieron algún signo o síntoma asociado al uso de desinfectantes. La barrera de protección más utilizada fueron los guantes (97%). El 67% de los odontólogos eliminó los desechos de desinfectantes por la coladera.

Conclusión: Para la limpieza de las áreas no críticas y críticas en las clínicas dentales se utilizan el hipoclorito de Sodio y compuestos de amonio cuaternario y/o etanol, sin embargo, no se utilizan las medidas adecuadas para su manejo. Es necesario implementar estrategias educativas para mejorar el uso y manejo de desinfectantes en la práctica dental.

PALABRAS CLAVE:

Consultorios odontológicos; Desinfectantes; Odontólogos; Pandemias; Desinfección; Estudios transversales

INTRODUCTION.

COVID-19 caused by the SARS-CoV-2 virus is a public health problem with serious environmental implications, due to the increase in the use and handling of disinfectants. Dental offices are places with a high number of patients and prone to cross-infections by COVID-19. Consequently, it is essential to have cleaning and disinfection procedures in the different clinical areas, namely: critical (space used by clinical staff) and non-critical (space used by administrative staff), which must be applied in a systematic way to protect the health of the community. These procedures must create safe spaces for individuals and the environment.^{1,2}

During the COVID-19 pandemic, the Centers for Disease Control and Prevention (CDC) recommended careful cleaning and disinfection of surfaces with 70% ethyl alcohol and 0.1% or 0.5%

Sodium hypochlorite (as required) for critical areas to help mitigate the transmission of SARS-CoV-2.³⁻⁵ However, hypochlorite must be handled with personal protection elements, prepared daily at the appropriate concentration and dilution (2000 mg/L), as well as stored and disposed of correctly, since it can be toxic, causing irritation to the airways and skin.⁶⁻⁹ In the environment, disinfectants have a negative impact on rivers, since some of these, when combined with nitrogen, form chloramine or N-nitrosodimethylamine, both substances identified as carcinogens.¹⁰

From January to March 2020, poison control centers in the United States reported a 20.4% increase in calls for exposure to the harmful effects of cleaning products and 16.4% for disinfectants.¹¹

The disinfectants associated with greater toxicity were hypochlorite (62.1%), non-alcoholic

disinfectants (36.7%), and hand sanitizers (36.7%). Adverse effects occurred in all age groups, but more frequently in children under 5 years of age. The route of exposure with the greatest increase was respiratory (108%) for all disinfectants. Improper use of cleaning products and disinfectants was also reported, such as using quantities greater than those indicated on the label, mixing chemical products, not using personal protective equipment, poorly ventilated areas, and inadequate storage of cleaning products.^{11,12}

There are some recent reports on the use and management of disinfectants in hospital settings, as well as adverse effects due to their exposure, which have increased since the start of the COVID-19 pandemic. However, there are no data in the dental field. Taking into consideration the above mentioned situation, it is necessary to determine the use and handling of disinfectants in critical and non-critical areas used by dentists in San Luis Potosí during the COVID-19 pandemic.

MATERIALS AND METHODS.

An observational study was carried out with a cross-sectional survey design, using the "Google Forms" platform. The survey was qualitatively validated by the researcher and its reliability was corroborated through the Cronbach coefficient ($\alpha=0.75$). It was applied online to 100 dentists in the state of San Luis Potosí, Mexico. The study was approved by the research ethics committee of the School of Stomatology with the code: CEI-FE-025-021

A total of 100 dentists from the state of San Luis Potosí with private and/or public practice, graduates of the Dentistry program, of both genders and who agreed to participate in the study, were included in consecutive fashion and for convenience. For the application of the survey, all the participants were informed about the handling of the data that was collected in accordance with the federal law for the protection of personal data (DOF 07-05-2010). Data collection was carried out from February to June 2021.

Statistical analysis

The data collected was exported to Excel® version 2013, and descriptive statistics were used; categorical variables were described using frequency and percentage tables.

RESULTS.

A total of 100 responses on the use and handling of disinfectants by dentists in San Luis Potosí were electronically recorded, finding the following points:

Personal, professional, and academic data of the dentists surveyed in San Luis Potosí.

Of the total population included (100 subjects), 37% were male and 63% female. Regarding age: 13% were 26 years old, 12% were 24 years old, and 9% 28 years old, the group with the lowest frequency were adults aged 50-60 years (3%). The type of dental practice reported for more than half of those surveyed was private (61%), public and private care (27%), and only public care (12%).

Data on the use and management of disinfectants that dentists use in their office.

The cleaning and disinfection protocols in the dental offices were mostly established by the dentists themselves (89%), 70% had prior training, 28% did not receive any training, and 2% did not consider it necessary.

The disinfectant used for cleaning and disinfection of non-critical areas in dental offices in this period of the COVID-19 pandemic was sodium hypochlorite (74%) (Figure 1). While the most widely used disinfectant for critical areas was Lysol® (80%) (Figure 2).

The most widely used disinfectants for dental office floors were hypochlorite (75%), Fabuloso® (58%), and Pinol® (55%). Ninety per cent of the disinfectants belonged to a registered brand and had a specific storage place; only 10% used bulk products and sometimes stored them in a specific place. 55% reported that they never mixed the products with each other.

Regarding the preparation of the disinfectants for the disinfection of floors, 63% of the dentists

Figure 1. Products used to clean non-critical areas in the dental office.

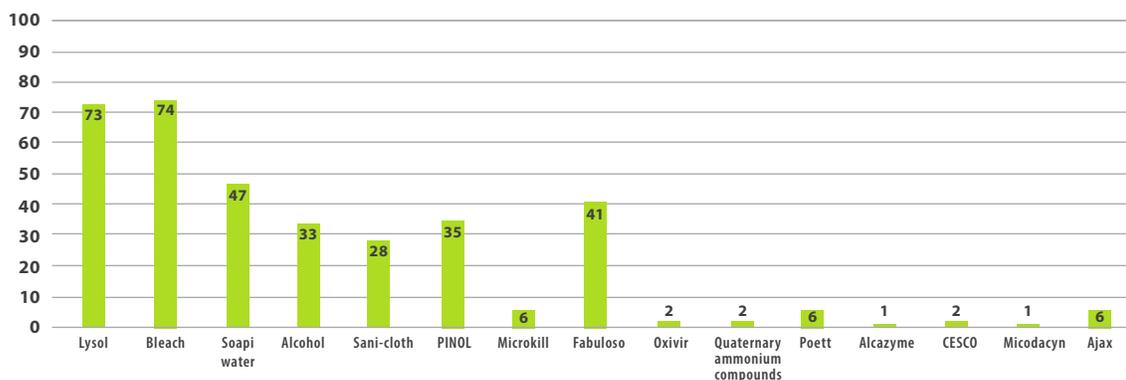


Figure 2. Products used to clean critical areas in the dental office

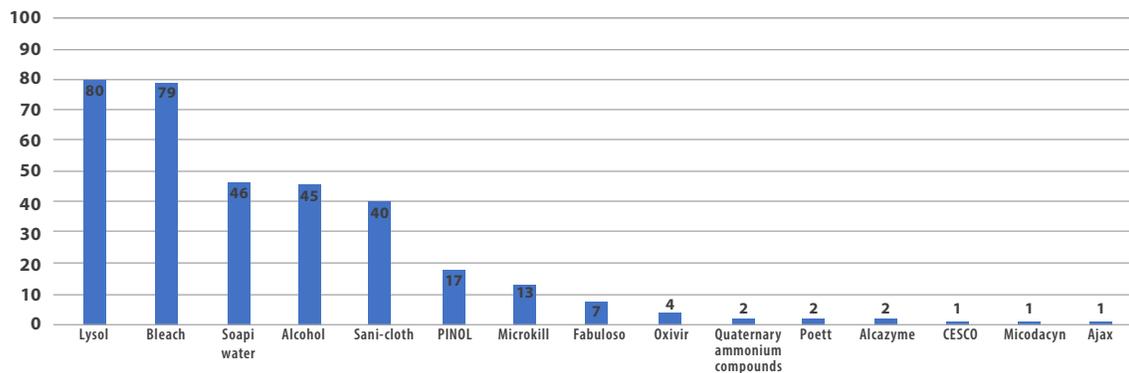


Figure 3. Amount of disinfectant liquid placed in a bucket based on one liter of water.

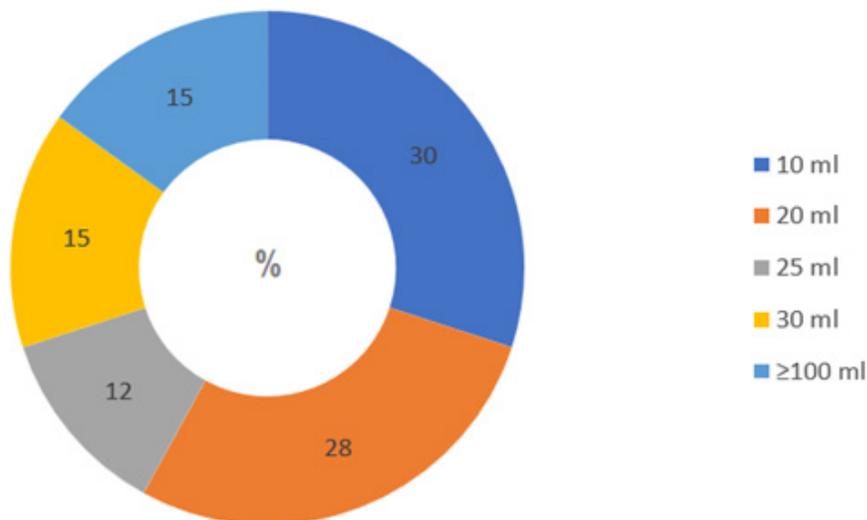


Figure 4. Adverse effects of improper use of disinfectants.

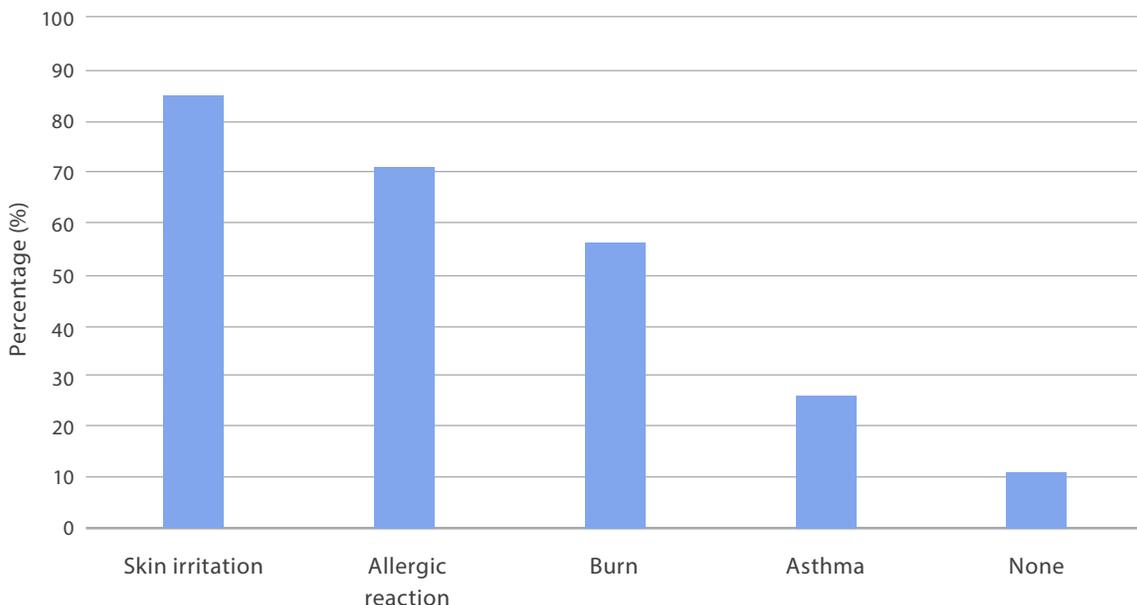
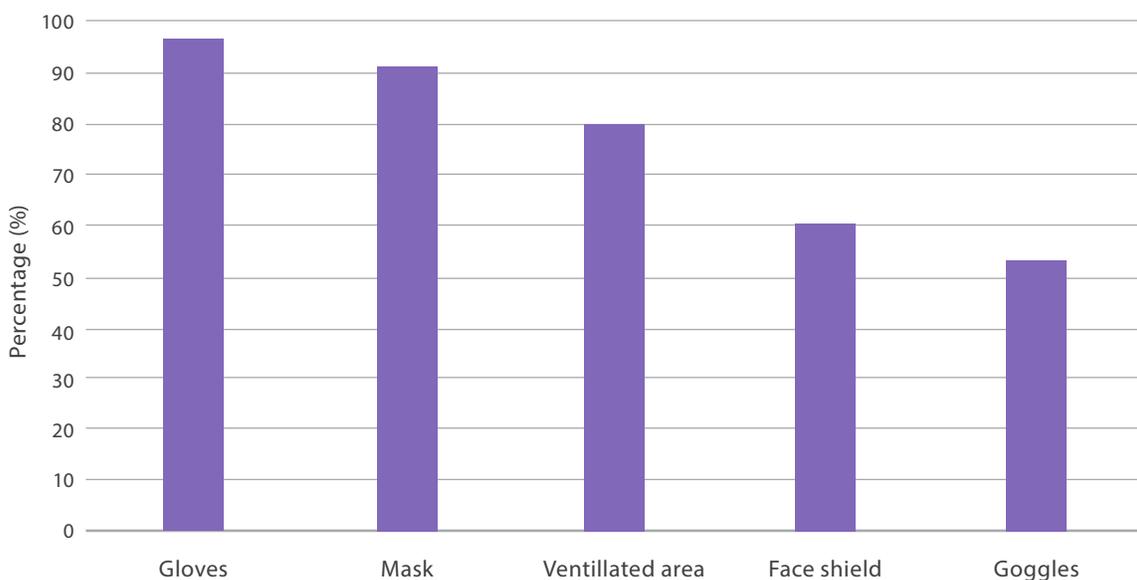


Figure 5. Precautionary measures used in the cleaning of the dental office.



did not use a measuring device, the quantity used was a personal decision. 30% used 10 ml of disinfectant for every liter of water (Figure 3). Knowledge about the adverse effects associated with exposure to disinfectants was evaluated, the best-known effect was skin irritation (Figure 4).

Data was collected on the protective measures used to handle disinfectants. It was found that most dentists wore gloves (97%) and face masks (91%) (Figure 5).

Harmful effects from exposure to disinfectants were documented and it was found that most respondents (72%) had not presented any sign or symptom, 21% reported irritation and flaking on the hands, 7% in the respiratory tract and 4% in the eyes. Finally, participants were asked about the disposal of waste, and it was found that (67%) of the dentists threw it in the drain, 30% in the toilet bowl, 25% in the sink, 5% to the plants/grass, and a 3% onto the pavement.

DISCUSSION.

This cross-sectional survey on the use of disinfectants by dentists was carried out in the context of the COVID-2019 pandemic in Mexico. It was identified that the most used disinfectant for critical areas was Lysol® and for non-critical areas, Sodium Hypochlorite.

However, Lysol® products have a wide range of presentations, from domestic to hospital and in various application forms, which were not described by the users. In general, these products contain Water, Benzalkonium Chloride <2 %, Ethyl alcohol <1%, Non-ionic surfactant, Fragrance, EDTA, Dyes; depending on the specific product, the components and indications may vary. It is a disinfectant product that has been approved by the US Environmental Protection Agency (EPA). However, it should be noted that only two products in the Lysol® family (Lysol Disinfectant Spray and Lysol Disinfectant Max Cover Mist) have been approved and tested as effective to eliminate COVID-19.

Their use in critical areas according to bibliographic reviews^{5,6,8,9} and recommendations from other institutions in charge of providing information on COVID-19, depends on the specific product and their times of effectiveness. The general use of quaternary ammonium compounds is recommended in non-critical areas as it is a low-level disinfectant. In addition, a contact time of 1-2 minutes is recommended on hard and non-porous surfaces, if used in this way the corrosive and deteriorating effect on surfaces can be avoided.^{5,6,8,9} The disinfection protocols have focused on the various existing products based on quaternary ammoniums and ethanol in relation to their effect on SAR-CoV-2; however, the EPA has a list of over 420 products that are powerful enough to kill SARS-Cov2. It can be inferred that many of these products have sufficient antiviral power despite the lack of specific tests against this virus. The use of disinfectants does not match the disinfectants recommended to eliminate SARS-CoV-2 in critical areas, since the start of the pandemic, the CDC has

recommended 70% ethanol with a contact time of 1-2 minutes to disinfect surfaces.

Among the reported adverse effects are dryness and irritation of the skin, irritation in the respiratory system, which can also cause asthma in some people.^{3,5, 6,8,12,13}

Another recommendation for the disinfection of critical areas is using 0.1% sodium hypochlorite, with a contact time of 8-10 minutes. For the disinfection of spills of blood or body fluids, a concentration of 0.5% and a contact time of 4-5 minutes are recommended.^{3,4}

However, there are some limitations in the use of hypochlorite since, on hard non-porous surfaces, it must be corrosive. Besides it requires proper handling such as storing in opaque containers, being properly labeled, in a well-ventilated covered area, away from direct sunlight and heat. These solutions should be prepared daily and stored in a closed and impermeable container at room temperature.^{4,11,12}

On the other hand, if no protection is used during its handling, it is necessary to know the adverse effects that the use of hypochlorite entails, which include: an increased risk of Chronic Obstructive Pulmonary Disease (COPD), asthma, and eye irritation. Also, one should keep in mind that it should never be mixed with other substances, as it can have serious side effects, such as the formation of chlorine gas.^{5,6,14}

This chemical reaction should be explained to dentists since 55% of those surveyed made mixtures with different disinfectant products. Consequently, educational measures should be implemented in this regard to prevent adverse effects.^{11,15}

Disinfection is necessary for all touched surfaces, for example: handles, tables, toilets, light switches, etc.¹² Regular cleaning between each patient is recommended.

Chemical residues left on a surface can become airborne and be eventually inhaled. Their exposure causes abrasions of the mucous membranes, gastrointestinal irritation, ear, nose and throat lesions, asthma symptoms, and abrasions by contact with

the skin.¹⁵ Respondents reported that they use protection barriers to handle them, such as gloves, face masks, keeping the area ventilated, wearing a face shield, and protective glasses.

The cleaning protocols for the offices were established by the dentists who trained the cleaning staff of their clinic, but the appropriate disinfectants and the measures proposed in the literature are not being adopted. It is necessary to establish strategies and cleaning protocols based on the evidence and personalized training of the cleaning staff to maintain adequate infection control.

Regarding the concentration of disinfectants that are used to clean clinical areas, most do not use measuring devices to calculate them properly, quantities are used at the discretion of the cleaning staff. The latter leads to the use of higher concentrations, causing adverse effects on users and the environment or less than those quantities recommended, preventing adequate elimination of the virus.⁴

Cleaning and disinfection products have a label indicating their correct handling. These must be read carefully.

Before disinfecting a surface, it must be washed, either with soap and water or some detergent. The disinfectant should be applied with cloths moistened with the substance.⁴

Regarding the management of residues or waste generated by the use of disinfectants, it was found that more than half of respondents dispose of them entirely in the drain, sink, toilet, and a smaller proportion to the plants or pavement. These practices contribute to environmental contamination since the proper indication for the disposal of waste is to pour it into drains connected to a sewerage network or a septic tank (a below ground chamber with porous walls that allows for the wastewater to drain and be absorbed slowly into the ground).²

Finally, the respondents do not carry out their cleaning and disinfection protocols according to the established criteria, it is necessary to implement intervention measures to improve them.

One of the strengths of the present study was exploring the use and management of disinfectants by dentists; a current issue due to the context of the COVID-19 pandemic. This will serve as the basis for formulating research hypotheses and designing future analytical studies. On the other hand, these results provide important data for planning biosafety intervention measures in dentistry.

Among the limitations of the study are those of a cross-sectional study design. That is, results obtained in a single moment, and not possible to follow up. In addition, the data come only from a sample, and for this reason they may not reflect the general use and management of disinfectants by dentists in Mexico.

As perspectives for future research, the implementation of educational measures on safe and effective cleaning and disinfection practices aimed at preventing the transmission of SARS-CoV-2 in dental clinics, as well as the design and implementation of intervention studies in dental practice to measure the impact on the rational use of disinfectants have been considered.

CONCLUSION.

For the cleaning of critical and non-critical areas in dental offices, disinfectants such as so-dium hypochlorite and products composed of quaternary ammonium and/or ethanol are used daily.

However, a large percentage do not adopt the appropriate measures for their handling and have not used these disinfectants rationally during the pandemic. It is necessary to implement educational strategies to improve the use of disinfectants in dental practice.

Conflict of interests:

The authors declare that they have no conflict of interest.

Ethics approval:

The study was approved by the research ethics committee of the School of Stomatology with the code: CEI-FE-025-021.

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Authors' contributions:

Aranda-Romo S: Conception of the idea, design of the work, data analysis, writing of the work and critical review, final approval of the version to be published.

Santana-González D: Data collection, review of the manuscript, final approval of the version to be published.

Cepeda-Bravo JA.: Review of the manuscript, final approval of the version to be published.

Aragón-Martínez HO: Review of the manuscript, final approval of the version to be published.

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