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(RESEARCH ARTICLE)

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Evaluation of microbiological contamination in the clinics of the faculty of dentistry of the university of Cuenca

Leslie Gabriela Rodas [1,*], Camila Alejandra Valverde [1], Fernanda Lisseth Lozano [1] and Manuel Estuardo Bravo [2]

[1] *Dentistry School, University of Cuenca, Cuenca, Ecuador.*
[2] *Orthodontics Dentistry Department, Dentistry School, University of Cuenca, Cuenca, Ecuador.*

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Abstract

Objective: To determine the bacterial load in the dental units of the undergraduate clinics and the radiology area of the Faculty of Dentistry of the University of Cuenca after the disinfection protocol used by the cleaning staff.

Introduction: Dentistry is considered a high-risk profession for that reason people who are part of the work team and the patients are exposed to pathogenic microorganisms. For this reason, it is too important and necessary to establish asepsis, antisepsis and biosafety protocols in order to reduce and prevent contamination and proliferation.

Materials and methods: A total number of 13 different surfaces were evaluated for the collection of the sample, the sterile Stuart transport medium was used to subsequently seed it in the blood agar media.

Results: At 48 hours there was no growth of colonies, however at 96 hours the following colonies were obtained: Adult clinic (*Bacillus spp*: 4000 CFU/ML), child clinic (*Bacillus spp:* 2000 CFU/ML, *Coagulase-negative Staphylococcus:* 1000 UFC/ML) and radiology (*Bacillus spp:* 1000 CFU/ML).

Conclusions: The cleaning and disinfection protocols used in the clinics and radiology service of the Faculty of Dentistry of the University of Cuenca are not enough to kill microorganisms completely. Although the CFUs were relatively lower compared to other studies, it is still a predisposing factor for infections in patients, operators, teachers and even cleaning staff.

Keywords: Contamination; Dental chairs; Cleaning and disinfection; Microorganisms; Bacteria

1. Introduction

The prevention and control of contamination is a fundamental aspect in the dental clinic for all the team and patients including cleaning staff because everyone is exposed to contracting infectious diseases [1].

Dentistry is considered a high-risk profession due to the exposure it faces daily. Professionals are exposed to various microorganisms that may be in the saliva and blood of patients for this reason the spittoon of the dental chair is considered a source of infection. On the other hand, patients are also considered vulnerable due to exposure to microorganisms directly or indirectly with body fluids, instruments, the dental chair and contaminated surfaces [2]. That means, it is necessary to implement asepsis, antisepsis, and biosafety protocols to prevent contamination of a sterile area, reduce the presence of pathogenic microorganisms, and prevent their proliferation. Disinfection can be physical or chemical and is classified as:

* Corresponding author: Leslie Gabriela Rodas Andrade
Dentistry School, University of Cuenca, Cuenca, Ecuador.

- High-level disinfection: Bacteria, bacilli, fungi and viruses are destroyed, except spores. (Glutaraldehyde, enzymatic soap, sodium hypochlorite.)
- Intermediate level disinfection: Inactivates *Mycobacterium tuberculosis.* (Ethyl or isopropyl alcohol, hypochlorite 200 ppm and iodophors.)
- Low level disinfection: It does not destroy spores, bacilli or viruses, it has a rapid activity against vegetative bacteria, fungi and lipophilic viruses. (Chlorhexidine and quaternary ammonium compounds.) [3].

The dental chairs are for collective and daily use because a lot of patients come to the different clinics of the faculty daily. Considering that each chair uses water to fulfill its functions, aerosols are generated and microorganisms are dispersed around. For this reason, the objective of our study is to determine the bacterial load in the dental units of the undergraduate clinics of the Faculty of Dentistry of the University of Cuenca after the disinfection protocol used by the cleaning staff.

2. Material and methods

A total of 13 surfaces were evaluated, corresponding to the adult clinic, the child clinic, and the radiology department of the Faculty. The surfaces evaluated were those with the greatest contact with the operator and the patient: the spittoon, the table, the lamp, the head of the chair, the handle of the triple syringe (child and adult clinic), the orthopantomography head and bite block, cephalostat olives (radiology department) using the hyssop for the Stuart transport media. To transport the samples to the laboratory where the crop was performed, each sample was labeled with different codes: Adult Clinic, Child Clinic and Radiology. It is important to mention that all samples were collected by the same operator.

Figure 1 Surfaces during sample collection

2.1. Sample collection

The hyssop technique was used as in the studies by Da Silva et al. [4] in 2004 and Lee [5] in 2010. The samples were collected 10 minutes after having concluded the clinical activities and after the disinfection carried out by the cleaning staff of the Faculty. To take the sample, the hyssop of the Stuart transport media was used, rubbing several times in a direction opposite to the previous one with an angle of 30°[6]. Subsequently, said swab was introduced into the sterile Stuart transport medium containing sodium thioglycolate to delay oxidation and thus subsequently seed it in the blood agar media.

2.2. Seeding of the sample dispersion - depletion:

The sample was spread on blood agar media using the dispersion technique. Then it was placed in the oven at a temperature of 37° for 24 hours, waiting to be able to identify bacterial colonies.

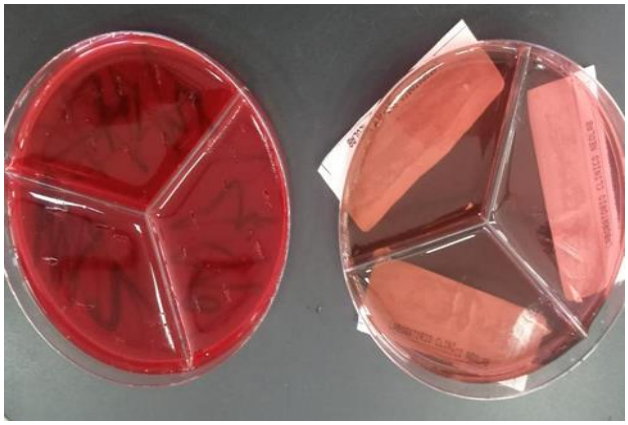

Figure 2 Sample collection

3. Results and discussion

- At 48 hours, no growth of colonies was obtained, so we decided to leave two more days to re-evaluate the growth of microorganisms because when surfaces are evaluated, 96 hours are required for the growth of microorganisms to be evidenced.
- After 96 additional hours, it was possible to determine that the count of Colony Forming Units (CFU) of each sample evaluated was positive, obtaining as a result the presence of Gram-positive microorganisms. (Fig. 3-4-5)

The CFU that were obtained in the crop were specifically two, *Bacillus spp* and *Coagulase-negative Staphylococcus* in the three areas evaluated. The presence of *Bacillus spp* was evidenced in the three areas evaluated with the highest prevalence; in the adult clinic (big) 4000 CFU/ML was found, followed by the child clinic 2000 CFU/ML and finally in radiology 1000 CFU/ML. In addition, in the child's clinic, *Coagulase-negative Staphylococcus* were found: 1000 CFU/ML. This result can be attributed to the fact that it is the area with the most influx of students and patients of the Faculty with more hours of care compared to the other areas. Although a great variety of microorganisms was not obtained, it should be considered that the samples were taken after the disinfection and cleaning process and even so these colonies prevailed. Taking into account the CFU, the adult clinic (big) was the area with the highest contamination, its result was 4000 CFU/ML. (Tab. 1)

Table 1 Crop results at 96 hours

Crop Results		
Adult Clinic	Headboard	*Bacillus spp:* 4000 UFC/ML
	Table	
	Spittoon	
	Triple Syringe Handle	
	Lamp	
Child's Clinic	Headboard	*Bacillus spp:* 2000 UFC/ML *Coagulase-negative Staphylococcus:* 1000 UFC/ML
	Table	
	Spittoon	
	Triple Syringe Handle	
	Lamp	
Radiology department	Orthopantomograph bite block	*Bacillus spp:* 1000 UFC/ML
	Orthopantomograph head	

	Cephalostat Olives	

PACIENTE

Apellidos y Nombres: CULTIVO CLINICA GRANDE
Identificación:
Médico:
Fecha del Informe:

Muestra: 1
Edad: 0 años
N° Pedido: 216
Servicio: EMPRESA

CULTIVO DE SUPERFICIES

Origen del organismo:	-		
ORGANISMO AISLADO	.		
		Nivel de confianza:	-
Información de Identificación:	Tarjeta: .	No. de Lote: .	Tiempo de Análisis: 00:00:0
Información de Sensibilidad:	Tarjeta: .	No. de Lote: .	Tiempo de Análisis: 00:00:0
Juego de Parámetros:	-		

TEST DE SUSCEPTIBILIDAD ANTIMICROBIANO Y/O LEVADURAS

Antibiótico	CMI	Interpretación

PRIMER RESULTADO PRELIMINAR (48 HORAS): NEGATIVO.
RESULTADO DEFINITIVO (96 HORAS):
BACILLUS SPP: 4000 UFC/ML

Figure 3 Incubation results at 96 hours (Adult Clinic)

PACIENTE

Apellidos y Nombres: CULTIVO RADIOLOGIA
Identificación:
Médico:
Fecha del Informe:

Muestra: 2
Edad: 0 años
N° Pedido: 216
Servicio: EMPRESA

CULTIVO DE SUPERFICIES

Origen del organismo:	-		
ORGANISMO AISLADO	.		
		Nivel de confianza:	-
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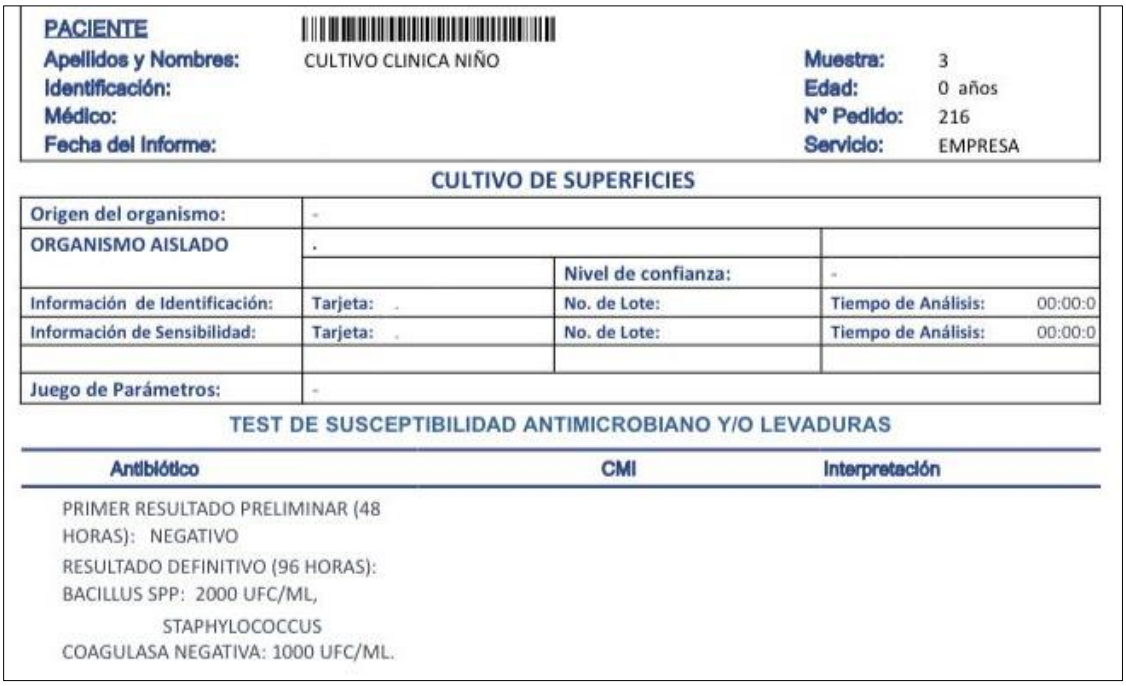
Información de Sensibilidad:	Tarjeta: .	No. de Lote:	Tiempo de Análisis: 00:00:0
Juego de Parámetros:	-		

TEST DE SUSCEPTIBILIDAD ANTIMICROBIANO Y/O LEVADURAS

Antibiótico	CMI	Interpretación

PRIMER RESULTADO PRELIMINAR (48 HORAS): NEGATIVO
RESULTADO DEFINITIVO (96 HORAS):
BACILLUS SPP: 1000 UFC/ML

Figure 4 Incubation results at 96 hours (Radiology)



PACIENTE

Apellidos y Nombres:	CULTIVO CLINICA NIÑO	Muestra:	3
Identificación:		Edad:	0 años
Médico:		N° Pedido:	216
Fecha del Informe:		Servicio:	EMPRESA

CULTIVO DE SUPERFICIES

Origen del organismo:	-		
ORGANISMO AISLADO	.		
		Nivel de confianza:	-
Información de Identificación:	Tarjeta: .	No. de Lote:	Tiempo de Análisis: 00:00:0
Información de Sensibilidad:	Tarjeta: .	No. de Lote:	Tiempo de Análisis: 00:00:0
Juego de Parámetros:	-		

TEST DE SUSCEPTIBILIDAD ANTIMICROBIANO Y/O LEVADURAS

Antibiótico	CMI	Interpretación

PRIMER RESULTADO PRELIMINAR (48 HORAS): NEGATIVO
RESULTADO DEFINITIVO (96 HORAS):
BACILLUS SPP: 2000 UFC/ML,
STAPHYLOCOCCUS
COAGULASA NEGATIVA: 1000 UFC/ML.

Figure 5 Incubation results at 96 hours (Child's Clinic)

4. Discussion

During clinical practice, there is a high degree of contamination because work is done directly in the mouth, and aerosols are produced, contaminating the work environment and the surfaces in greatest contact with the patient. It is important to mention that the faculty promotes and implements cleaning and disinfection protocols to control infections that may be generated by the entry and exit of patients, students, and tutor teachers.

As mentioned above, all the areas analyzed were contaminated despite being previously disinfected, obtaining a value between 1,000 and 4,000 CFU of microorganisms; this data can be contrasted with the study by Caicedo and Acosta [7], where they found values of 386.79 CFU/ML of aerobic bacteria after cleaning the spittoons of the dental units of the Faculty of Dentistry of the Central University of Ecuador.

The CFU values found in our study were higher when compared to the study by Santos et al. [8]. However, in both there is a coincidence of contamination even after the disinfection of the surfaces that correspond to this area. In this way, it can be corroborated that the cleaning and disinfection protocol provided at the faculty is deficient because it does not eliminate completely the existing microorganisms on the surfaces of greatest contact with patients and operators.

In the study carried out by Guillén [9], the contamination of non-sterilizable surfaces in the dental care unit of the Autonomous Regional University of the Andes was analyzed through a microbiological analysis, identifying the presence of a wide variety of microorganisms before cleaning and disinfection. Nevertheless, after the application of hydrogen peroxide as a disinfection substance, it demonstrated its effectiveness on microorganisms. For this reason, the use of hydrogen peroxide is recommended as a disinfection method in the clinics of the Faculty.

On the other hand, Bustamante et al. carried out a study on the bacterial contamination generated by aerosols in the dental environment and as in the present study they founded *Bacillus spp.* (28.56%) and *Coagulase-negative Staphylococcus* (5.52%) [10].

The importance of analyzing these results is reflected in the high pathogenic potential of these microorganisms because they could become opportunistic pathogens able of causing infections in immunosuppressed patients. These can be, *Corynebacterium, Bacillus, Coagulase-negative Staphylococcus* and some species of *Streptococcus* [11].

The genus *Bacillus* is Gram-positive aerobic or sometimes facultative anaerobic, its morphology is bacillary and its size is variable (0.5 to 10 µm), its mobility is thanks to its flagella. It requires a neutral pH for its growth, most of its species

are mesophilic that means they remain at temperatures between 30 and 45 °C and they also have the ability to produce endospores (oval or cylindrical) as a mechanism of resistance to various types of stress [12].

Coagulase-negative Staphylococcus are colonizers of the skin and mucous membranes, they are classified as *Staphylococcus epidermidis* and *Staphylococcus saprophyticus*. These microorganisms can cause diseases that can have serious consequences with bacteremia, urinary infection and infection related to catheters and prostheses [13].

There were certain limitations in this study, such as the lack of a microbiology laboratory in the faculty, which prevented obtaining a larger sample size and evaluating more areas. For this reason, it is recommended to take it into account for further studies.

5. Conclusion

Finally, after this study we concluded that the cleaning and disinfection protocols used in the clinics and radiology service of the Faculty of Dentistry of the University of Cuenca are deficient because although the samples were taken after this process, there was the presence of opportunistic microorganisms that can become pathogens.

Although the CFUs were relatively lower compared to other studies, it is still a predisposing factor for infections in immunocompromised patients including healthy patients, operators, teachers and even the cleaning staff.

That is why it is recommended to restructure cleaning and disinfection protocols and also use bactericidal agents such as hydrogen peroxide, which has been evaluated as an option to eliminate these microorganisms present on the surfaces with the greatest contact in dental units.

Compliance with ethical standards

Acknowledgments

We thank Dr. Manuel Bravo who guided us so that this research project is carried out successfully to achieve the desired objective.

Disclosure of conflict of interest.

There are no conflicts of interest in this study

Compliance with Ethical Standards.

The present research work does not contain any studies performed on animals/ humans subjects by any of the authors.

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