

## Evaluation of microbiological contamination in the dental services of the ministry of public health of the city of Cuenca-Ecuador

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### Abstract

**Introduction:** The control of microorganisms present on the surfaces of the dental environment is a critical factor. Contamination from these pathogens can occur through direct or indirect contact between surfaces and clinical staff. Stopping cross infection in dental offices represents a great challenge for dentists and microbiologists.

**Objective:** To compare the bacterial load of the dental units of the centers of the Ministry of Public Health, after the disinfection process, in the interval of attention from one patient to another; in the city of Cuenca, Ecuador.

**Materials and methods:** It is a cross-sectional analytical observational study, which analyzes 12 surfaces from 3 centers of the Ministry of Public Health (MSP) in the city of Cuenca-Ecuador, selected at random.

**Results:** Samples were isolated on 4 surfaces, each from 3 health centers; where 4 microorganisms were identified among them: Streptococcus viridans, Bacillus Subtilis, Yeasts and Staphylococcus coagulase negative, where the most prevalent was Bacillus subtilis.

**Conclusion:** The cleaning protocols are deficient; it is recommended to carry out periodic controls on the quality of disinfection in public dental health care centers.

**Keywords:** Biological contamination; Microbiota; Dentistry; Microorganisms

### 1. Introduction

The control of microorganisms present on the surfaces of the dental environment is a critical factor (1). The frequent use of rotary, ultrasonic material, air and water syringes creates aerosol particles (2), which due to the action of gravity will easily contaminate the surfaces of the office during dental treatment, becoming a reservoir of pathogens (1) (3). Many infectious diseases can be transmitted in the dental office between patients and clinical staff, due to the constant contact with blood and saliva. Contamination of these pathogens can occur through direct or indirect contact between surfaces and clinical personnel (1).

Stopping cross infection in dental offices represents a great challenge for dentists and microbiologists. Microorganisms are often capable of overcoming the security measures adopted, putting professionals and patients at risk (4). Based on this, it is vitally important to adopt an adequate infection control protocol that includes cleaning and disinfection of surfaces, hand washing, and protective barriers (3).

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Therefore, the objective of this work is to compare the bacterial load of the dental units found in the dental units of the centers of the Ministry of Public Health, after the disinfection process, in the interval of attention from one patient to another; in the city of Cuenca, Ecuador

## 2. Material and methods

### 2.1. Type of study

This is a cross-sectional analytical observational study, where a total of 12 areas of three medical centers in the city of Cuenca

### 2.2. Selection of the research field

To select the field of study, 3 health centers distributed within the city of Cuenca.

### 2.3. Sample collection

The sample was taken by a single researcher to avoid variations in the collection technique, where, to avoid contamination of the sample, protection barriers such as gloves, mask and cap were used. Samples were collected after dental care and before the next patient was admitted. For the collection of the sample, the Stuart transport medium was used, where the surface to be analyzed was rubbed several times and the sample was stored in the tube with the preservative solution, which contains sodium thioglycolate to delay oxidation and to their subsequent inoculation on blood agar media. The samples were collected in 3 health subcenters, which were labeled with the codes: MSP 1, MSP 2 and MSP 3. In each subcenter, those surfaces that come into greater contact with the operator and the patient were considered to be evaluated, such as: tip of the triple syringe, tip of the light curing lamp, support table of the dental unit and turbine (figure 1), obtaining a total of 12 evaluated surfaces.

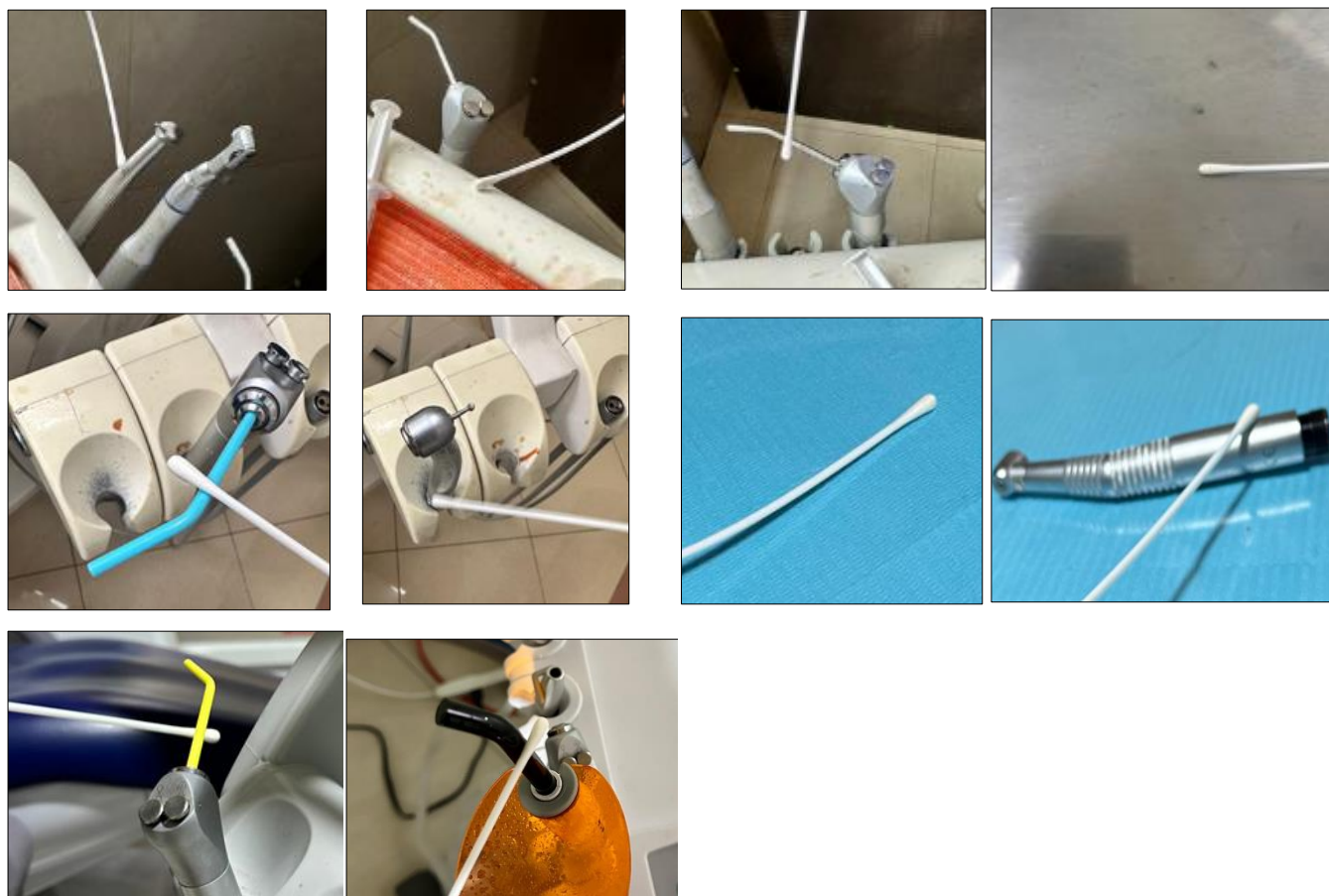


Figure 1 Surfaces during sampling

### 2.4. Dispersion seeding of the depletion sample

The sample is spread on blood agar medium using the dispersion technique. It was then placed in the oven for 24 hours, waiting to be able to identify bacterial colonies.



Figure 2 VITEK 2 COMPACT

### 3. Results

After 48 hours of sowing the samples, it was possible to identify the microorganisms of certain colonies, while others, due to their slow growth, prevented their recognition, so it was decided to wait for their correct identification. After 72 hours of waiting, it was possible to determine that the count of Colony Forming Units (UFC) of each sample evaluated was positive, obtaining as a result the presence of Gram positive microorganisms.

The CFU determined in the study were four: Bacillus subtilis, Streptococcus viridans, yeasts, and coagulase-negative Staphylococcus. The presence of these microorganisms are divided as follows:

- In the MSP1 (image 3) the Bacillus subtilis was evidenced in the triple syringe (4000 CFU). at the tip of the light-curing lamp (1000 CFU), and at the turbine (10,000 CFU). Coagulase-negative Staphylococcus was found on the dental unit table (8000 CFU).

<b>PACIENTE</b>			
Apellidos y Nombres:	MSP1 MESA	Muestra:	1
Identificación:		Edad:	0 años
Médico:		N° Pedido:	44
Fecha del Informe:		Servicio:	EMPRESA
<b>CULTIVO DE AMBIENTE</b>			
Origen del organismo:	VITEK 2 BioMérieux, Inc.		
ORGANISMO AISLADO	Staphylococcus coagulasa negativo	99 % Probabilidad	
		Nivel de confianza:	Excelente
Información de Identificación:	Tarjeta: GP	No. de Lote: 2422140103	Tiempo de Análisis: 06:19:0
Información de Sensibilidad:	Tarjeta:	No. de Lote:	Tiempo de Análisis: 00:00:0
Recuento:	8000 UFC		
Juego de Parámetros:	-		

Support table





<b>PACIENTE</b>			
Apellidos y Nombres:	MSP1 TURBINA	Muestra:	2
Identificación:		Edad:	0 años
Médico:		N° Pedido:	44
Fecha del Informe:		Servicio:	EMPRESA
<b>CULTIVO DE AMBIENTE</b>			
Origen del organismo:	VITEK 2 BioMérieux, Inc.		
ORGANISMO AISLADO	Bacillus subtilis		99 % Probabilidad
		Nivel de confianza:	Excelente
Información de Identificación:	Tarjeta: GP	No. de Lote: 2422140103	Tiempo de Análisis: 05:39:0
Información de Sensibilidad:	Tarjeta:	No. de Lote:	Tiempo de Análisis: 00:00:0
Recuento:	10 000 UFC		
Juego de Parámetros:	-		
Turbine			
<b>PACIENTE</b>			
Apellidos y Nombres:	MSP1 LAMPARA	Muestra:	3
Identificación:		Edad:	0 años
Médico:		N° Pedido:	44
Fecha del Informe:		Servicio:	EMPRESA
<b>CULTIVO DE AMBIENTE</b>			
Origen del organismo:	VITEK 2 BioMérieux, Inc.		
ORGANISMO AISLADO	Bacillus subtilis		99 % Probabilidad
		Nivel de confianza:	Excelente
Información de Identificación:	Tarjeta: GP	No. de Lote: 2422140103	Tiempo de Análisis: 05:58:0
Información de Sensibilidad:	Tarjeta:	No. de Lote:	Tiempo de Análisis: 00:00:0
Recuento:	1000 UFC		
Juego de Parámetros:	-		
<b>PACIENTE</b>			
Apellidos y Nombres:	MSP1 JERINGA TRIPLE	Muestra:	4
Identificación:		Edad:	0 años
Médico:		N° Pedido:	44
Fecha del Informe:		Servicio:	EMPRESA
<b>CULTIVO DE AMBIENTE</b>			
Origen del organismo:	VITEK 2 BioMérieux, Inc.		
ORGANISMO AISLADO	Bacillus subtilis		99 % Probabilidad
		Nivel de confianza:	Excelente
Información de Identificación:	Tarjeta: GP	No. de Lote: 2422140103	Tiempo de Análisis: 06:11:0
Información de Sensibilidad:	Tarjeta:	No. de Lote:	Tiempo de Análisis: 00:00:0
Recuento:	4000 UFC		
Juego de Parámetros:	-		
triple tip syringe			
<b>PACIENTE</b>			
Apellidos y Nombres:	MSP1 LAMPARA	Muestra:	3
Identificación:		Edad:	0 años
Médico:		N° Pedido:	44
Fecha del Informe:		Servicio:	EMPRESA
<b>CULTIVO DE AMBIENTE</b>			
Origen del organismo:	VITEK 2 BioMérieux, Inc.		
ORGANISMO AISLADO	Bacillus subtilis		99 % Probabilidad
		Nivel de confianza:	Excelente
Información de Identificación:	Tarjeta: GP	No. de Lote: 2422140103	Tiempo de Análisis: 05:58:0
Información de Sensibilidad:	Tarjeta:	No. de Lote:	Tiempo de Análisis: 00:00:0
Recuento:	1000 UFC		
Juego de Parámetros:	-		
Lamp			

Figure 3 Culture subcenter of the Ministry of Public Health (MSP) 1

- In MSP2 (image 4) yeasts were found in the triple syringe (2000 CFU), Bacillus subtilis was found at the tip of the light curing lamp (2000 CFU), in the turbine (2000 CFU) and on the processing table. the dental unit (10,000 UFC).

<b>PACIENTE</b>					
Apellidos y Nombres:	MSP2 MESA	Muestra:	5	Edad:	0 años
Identificación:		N° Pedido:	44	Servicio:	EMPRESA
Médico:					
Fecha del Informe:					
<b>CULTIVO DE AMBIENTE</b>					
Origen del organismo:	VITEK 2 BioMérieux, Inc.				
ORGANISMO AISLADO	Bacillus subtilis			99 % Probabilidad	
		Nivel de confianza:	Excelente		
Información de Identificación:	Tarjeta: GP	No. de Lote: 2422140103	Tiempo de Análisis:	05:58:0	
Información de Sensibilidad:	Tarjeta:	No. de Lote:	Tiempo de Análisis:	00:00:0	
Recuento:	10 000 UFC				
Juego de Parámetros:	-				

Support table

<b>PACIENTE</b>					
Apellidos y Nombres:	MSP2 TURBINA	Muestra:	6	Edad:	0 años
Identificación:		N° Pedido:	44	Servicio:	EMPRESA
Médico:					
Fecha del Informe:					
<b>CULTIVO DE AMBIENTE</b>					
Origen del organismo:	VITEK 2 BioMérieux, Inc.				
ORGANISMO AISLADO	Bacillus subtilis			99 % Probabilidad	
		Nivel de confianza:	Excelente		
Información de Identificación:	Tarjeta: GP	No. de Lote: 2422140103	Tiempo de Análisis:	05:47:0	
Información de Sensibilidad:	Tarjeta:	No. de Lote:	Tiempo de Análisis:	00:00:0	
Recuento:	2000 UFC				
Juego de Parámetros:	-				

Turbine



<b>PACIENTE</b>					
Apellidos y Nombres:	MSP2 JERINGA TRIPLE	Muestra:	8	Edad:	0 años
Identificación:		N° Pedido:	44	Servicio:	EMPRESA
Médico:					
Fecha del Informe:					
<b>CULTIVO DE AMBIENTE</b>					
Origen del organismo:	VITEK 2 BioMérieux, Inc.				
ORGANISMO AISLADO	Levaduras			99 % Probabilidad	
		Nivel de confianza:	Excelente		
Información de Identificación:	Tarjeta: YST	No. de Lote: 2431943503	Tiempo de Análisis:	07:53:0	
Información de Sensibilidad:	Tarjeta:	No. de Lote:	Tiempo de Análisis:	00:00:0	
Recuento:	2000 UFC				
Juego de Parámetros:	-				

triple tip syringe

<b>PACIENTE</b>					
Apellidos y Nombres: MSP2 LAMPARA				Muestra: 7	
Identificación:				Edad: 0 años	
Médico:				N° Pedido: 44	
Fecha del Informe:				Servicio: EMPRESA	
<b>CULTIVO DE AMBIENTE</b>					
Origen del organismo:	VITEK 2 BioMérieux, Inc.				
ORGANISMO AISLADO	Bacillus subtilis		99 % Probabilidad		
			Nivel de confianza:	Excelente	
Información de Identificación:	Tarjeta: GP	No. de Lote: 2422140103	Tiempo de Análisis: 05:56:0		
Información de Sensibilidad:	Tarjeta:	No. de Lote:	Tiempo de Análisis: 00:00:0		
Recuento:	2000 UFC				
Juego de Parámetros:	-				
Lamp					

**Figure 4** Culture subcenter of the Ministry of Public Health (MSP) 2

In MSP3 (image 5) *Bacillus subtilis* was found in the triple syringe (5,000 CFU), at the tip of the light-curing lamp (20,000 CFU), and in the turbine (2,000 CFU). *Streptococcus viridans* was found on the table in the dental unit (40,000 CFU).

<b>PACIENTE</b>					
Apellidos y Nombres: MSP3 MESA				Muestra: 9	
Identificación:				Edad: 0 años	
Médico:				N° Pedido: 44	
Fecha del Informe:				Servicio: EMPRESA	
<b>CULTIVO DE AMBIENTE</b>					
Origen del organismo:	VITEK 2 BioMérieux, Inc.				
ORGANISMO AISLADO	Streptococcus viridans		99 % Probabilidad		
			Nivel de confianza:	Excelente	
Información de Identificación:	Tarjeta: GP	No. de Lote: 2422140103	Tiempo de Análisis: 06:19:0		
Información de Sensibilidad:	Tarjeta:	No. de Lote:	Tiempo de Análisis: 00:00:0		
Recuento:	40 000 UFC				
Juego de Parámetros:	-				
Support table					
<b>PACIENTE</b>					
Apellidos y Nombres: MSP3 TURBINA				Muestra: 10	
Identificación:				Edad: 0 años	
Médico:				N° Pedido: 44	
Fecha del Informe:				Servicio: EMPRESA	
<b>CULTIVO DE AMBIENTE</b>					
Origen del organismo:	VITEK 2 BioMérieux, Inc.				
ORGANISMO AISLADO	Bacillus subtilis		99 % Probabilidad		
			Nivel de confianza:	Excelente	
Información de Identificación:	Tarjeta: GP	No. de Lote: 2422140103	Tiempo de Análisis: 06:58:0		
Información de Sensibilidad:	Tarjeta:	No. de Lote:	Tiempo de Análisis: 00:00:0		
Recuento:	2000 UFC				
Juego de Parámetros:	-				
Turbine					

<b>PACIENTE</b>			
Apellidos y Nombres:	MSP3 JERINGA TRIPLE	Muestra:	12
Identificación:		Edad:	0 años
Médico:		N° Pedido:	44
Fecha del Informe:		Servicio:	EMPRESA
<b>CULTIVO DE AMBIENTE</b>			
Origen del organismo:	VITEK 2 BioMérieux, Inc.		
ORGANISMO AISLADO	Bacillus subtilis		99 % Probabilidad
		Nivel de confianza:	Excelente
Información de Identificación:	Tarjeta: GP	No. de Lote: 2422140103	Tiempo de Análisis: 05:51:0
Información de Sensibilidad:	Tarjeta:	No. de Lote:	Tiempo de Análisis: 00:00:0
Recuento:	5000 UFC		
Juego de Parámetros:	-		
triple tip syringe			
<b>PACIENTE</b>			
Apellidos y Nombres:	MSP3 LAMPARA	Muestra:	11
Identificación:		Edad:	0 años
Médico:		N° Pedido:	44
Fecha del Informe:		Servicio:	EMPRESA
<b>CULTIVO DE AMBIENTE</b>			
Origen del organismo:	VITEK 2 BioMérieux, Inc.		
ORGANISMO AISLADO	Bacillus subtilis		99 % Probabilidad
		Nivel de confianza:	Excelente
Información de Identificación:	Tarjeta: GP	No. de Lote: 2412140103	Tiempo de Análisis: 06:42:0
Información de Sensibilidad:	Tarjeta:	No. de Lote:	Tiempo de Análisis: 00:00:0
Recuento:	20 000 UFC		
Juego de Parámetros:	-		
Lamp			

Figure 5 Culture subcenter of the Ministry of Public Health (MSP) 3

#### 4. Discussion

Dental care generates a high degree of contamination, the production of aerosols causes the different surfaces to become contaminated. Due to this, disinfection of the workplace should be carried out in each office after each patient's care to reduce the risk of contagion. The role of environmental contamination in the transmission of healthcare-associated infections is poorly understood. Cleaning and disinfection of healthcare settings and medical devices associated with hand hygiene are a higher infection control priority (8).

As previously mentioned, all the areas analyzed were contaminated despite having been previously disinfected, obtaining a value between 1,000 and 40,000 CFU of microorganisms. The CFU values found in our study were higher when compared to the study by Santos et al. since in his study the most prevalent were gram-negative bacilli (*Pseudomona stutzeri*) and less frequently gram-positive cocci such as *Enterococcus faecalis* (6). However, in both there is a coincidence of contamination even after disinfection of the surfaces that correspond to this area. In this way, it can be confirmed that the cleaning and disinfection protocol provided in the dental departments of the MSP are deficient, because they do not completely eliminate existing microorganisms on the surfaces with the greatest contact with patients and operators.

Coagulase-negative *Staphylococcus* are the most common microorganism isolated in blood cultures (6), colonizers of the skin and mucous membranes, and are classified as *Staphylococcus epidermidis* and *Staphylococcus saprophyticus*. These microorganisms can cause diseases that can have serious consequences with bacteremia, urinary infection, and infections related to catheters and prostheses (7). On the other hand, we find *Bacillus subtilis*, which, due to endospores that give it its resistance to cleaning media, can persist under hot and dry conditions in the environment. As well as the production of proteases and enzymes that give it a variety of natural substrates that contribute to the nutrient cycle. (8)

The results show that there is a higher prevalence of *Bacillus Subtilis* colonies, representing 75% of the total surfaces examined being present, being the support table where the highest values were found, being between 20,000 and 40,000 CFU.

A limitation of this study was that the collection sample is small, it is necessary to have a record of all the dental units of the MSP in Cuenca - Ecuador and due to the price of inputs and sample collection, 3 randomized subcenters were lost. However, this study has strengths since the samples taken are from the main surfaces and equipment that are in contact with the operator and the patient, providing a quantitative and qualitative description of the bacterial colonies found.

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## 5. Conclusion

Finally, after analyzing the results of the cultures, it was concluded that the disinfection processes used during dental care are not efficient, since among the isolated strains microorganisms such as: *Streptococcus viridans*, *Bacillus Subtilis*, Yeasts and coagulase negative staphylococcus. Therefore, it is recommended to carry out periodic controls on the quality of disinfection carried out in the city's health centers, since they represent an important predisposing factor for infections in the population, mainly immunocompromised, but without ceasing to be a risk for patients. healthy, operators and cleaning staff.

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## Compliance with ethical standards

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### *Disclosure of conflict of interest*

There are no conflicts of interest between the authors of the manuscript.

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