QUANTITATIVE ANALYSIS OF BACTERIAL CONTAMINATION IN DENTAL LABORATORY AIR

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ABSTRACT

The aim of this study was to analyse quantitative air pollution in dental laboratory at different times of the daily activity. We used the method of collection by sedimentation (Koch) which consisted of opening and exposure of Petri dishes with culture medium-based agar. Five samples were placed in different work areas in all three rooms of the dental laboratory. Recordings were made at the beginning of the workday, during the execution of certain specific manoeuvres and at the end of working day. All data were statistically processed, results are expressed as mean values recorded for each point of determination. Results emphasize the importance of staff awareness of dental labs on health risks caused by air contamination workspaces.

Keywords: dental laboratory infection, microbiology, occupational exposure, risk factor.

INTRODUCTION

Prosthetic technological algorithm in prosthesis construction achievement involves of a variety of stages, after which appears both: pollution and contamination in atmospheric air, which can cause serious health damage in all dental team members. Dental technicians, during their profession, contact several harmful factors and their harmful effects depending on toxic concentration in air and exposure in time.

Studies to date indicate that the most common diseases in dental technicians are located in respiratory system and consist of silicosis, berylliosis, interstitial pneumonia, pulmonary fibrosis, asthma, chronic obstructive bronchopneumopathy, allergic respiratory reactions, reduced respiratory capacity, and emphysema.

Dust from processing prosthesis parts is often microbial contaminated. Motor rotation speeds are typically high, thus generating very fine powder, usually less than 5 microns, which penetrate pulmonary alveoli. Harmfully potential is conditioned by particle size, concentration, composition, time exposure (often more than ten years) [1].

There are numerous studies that analyse the microbial air in dental offices and the contamination risk due to trespassing strictly prophylactic rules. Pathogens are rarely as singular form of microbial body as they get in air set on particles inside on layer which contains them (drops of secretion, fibbers, dust) [2].

Protocols for dental offices activity provide air decontamination using germicidal lamps generating ultraviolet radiation. Approximately 95% of the radiation have germicidal wavelength of 253, 7 nm. The remaining 5% is

the radiation wavelength of 184.9 nm, producing ozone effect also germicide. Time for action indicated is 20 minutes.

In the dental laboratory, the situation is less known [3]. Therefore, in this study we proposed quantitative determination of germs in air vehicle inside of dental laboratory. Research aimed comparative analysis of data recorded at the beginning of the working day during manoeuvres processing and end of the workday.

MATERIALS AND METHODS

The study was conducted in Dental Technique Laboratory of Clinical Base Medical Dentistry Education.

To achieve this quantitative analysis, we used collection method by sedimentation (Koch), which consisted in opening and exposure of Petri dishes with a diameter of 90 mm. Their inoculation was done on preformed solid culture medium, based on agar-agar. In each of three rooms of the dental laboratory five samples were placed in various work areas; first samples were left uncovered for 15 minutes at workday beginning (Fig. 1). Next samples group was obtained from inoculations made during the execution of specific working manoeuvres (unpacking, metal surface treatments, machining and polishing of acrylic dentures). The last samples group was recorded at the end of working day, after decontamination rooms. In total, for each stage of registration

15 samples were used, so a total of 45 samples were examined.

The chosen method for harvesting germs from the air took into account the following considerations: method must be effective for particle sized between 1 and 10 μm, and able to assess bacteria's number per cubic meter in air.

After exposure, the boxes were sealed and sent to microbiology laboratory. Samples were incubated for 24 hours at 37° C and were allowed an additional 24 hours at room temperature and light, in order to species bacterial specific pigments developing. Followed bacteriological indicator was the number of unit's colony forming and total mesophilic bacteria. Colonies were counted starting from the premise that each colony has grown from a microorganism, and by counting all colonies, we obtained the total number of bacteria (Fig. 2).

The method used is simple and allows simultaneous multiple determinations, thus achieving very accurate characterization of air contamination.

To express the microbial load per unit air volume, Omeliansky formula we used, which is based on the observation, those germs from 10 litters of air are deposed on a surface of $100 \ cm^2$ in 5 minutes. The formula is:
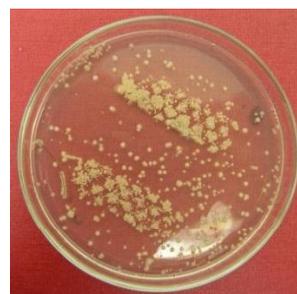
Number germs/ air m^3 n X 10000: S T/ 5, where n is the number of colonies developed on culture medium surface, S is the Petri dish surface in cm^2, and T is time exposure in minutes.

Fig. 1. Petri dishes placed in laboratory at the beginning of working day

Fig. 2. Petri dishes after incubation

	At the beginning of the working day (UFC/m3)	During specific manoeuvres (UFC/m3)	At the end of the working day (UFC/m3)
Fixed prostheses Laboratory	20	234	52
Ceramic Laborator	15	390	40
Processing Laborator	34	546	75

Table 1. Microbial load in dental laboratory air

RESULTS

Determination of units number that forming colony per cubic meter in air, allowed assessing the microbial load in all three rooms of dental laboratory at different stages of the day. Data obtained were statistically processed and results are expressed as mean values recorded for each point of determination. To enable a quantitative understanding of air microbial flora in all three rooms of laboratory, we synthesized values for mesophilic aerobic bacterial count in the following table (Table 1).

DISCUSSION

For air bacterial content so far there are no standards or rules indicating by which degree of air contamination could be assessed. In room is accepted as the maximum limit of mesophilic microorganism's content value 1500 - 2500 CFU/m³ air. Results achieved in our study fall within the limits in the specialty literature. The highest values were obtained corresponding to periods of intense work while performing specific manoeuvres. Values recorded at the end of the working day, after decontamination, were lower than those obtained during the work stages. This underlines the need for daily air decontamination in workspaces and use specific measures to protect personnel.

It is recommended to capture dust at point where emission exhausting and discharge it externally (i.e. by using sandblasting with externally exhausting) and adequate air refreshment (40 m³/hour/persona). It is also necessary to use specific protective equipment: goggles, gloves, and masks dust protection [4, 5].

Health surveillance of dental technicians requires an assessment of the respiratory system.

CONCLUSION

Installations to capture pollution in work without recirculation of polluted air, ventilation and air decontamination done at the end of the workday, are prerequisites for maintaining health and preventing professionally diseases of staff in dental labs.

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