Short Communication

Microbiological air analysis in dental surgeries: a comparison between two methods

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Abstract

The microbiological quality of indoor air is creating an increasing interest especially as far as places at risk such as hospitals, clinics, medical and odontological surgeries are concerned. Working with the odontologists of our province we have been carrying out a research aimed at preventing cross-infection in odontology. Data obtained from the microbiological analysis of the air in 36 surgeries using S.A.S. were discussed during the V National Congress of Aerobiology. During that congress the need of setting a standardized technique of air sampling in indoor environments emerged and two routes have been identified: (1) the gravimetric technique on open plate exposed for an hour close to the dental unit and (2) the use of the volumetric sampler which gives qualitative data expressed as colonies forming units per cubic metre of air. However, both of these techniques present some problems: using the first a loss of micro-organisms has been noticed due to the variability of the air fluxes and the different weight of the biological particles; using the second one the bacterial charge is also undervalued, because of the stress suffered by the bacteria with the use of the volumetric sampler. In the light of these statements we decided to use both in dental surgeries to be able to compare the results obtained. Our project is expected to carry out at least one inspection and the relative sampling (indoor air, water of the dental unit, air of the syringe, disinfectant solution, surface tampons, biological test of sterility) in each dental surgery in the territory of our health Unit, located in Ferrara, Northern Italy.

Keywords: Air quality; Dental surgery; Environment; Surface tampons

1. Introduction

The evaluation of the microbiological quality of indoor air is creating an increasing interest especially as far as high risk places such as hospitals, clinics, medical and dental surgeries are concerned (Berardi and Leoni, 1993).

Working with the odontologists practising in the territory of Ferrara, we are studying the possibilities to prevent dental cross-infections (Pitzurra, 1984). This research consists of the following phases: (a) Compilation of an anamnestic schedule relative to each surgery containing (1) data about legal permissions (hygienic-sanitarian suitability, rx sets, getting rid ways of waste materials), (2) used procedures of prevention of the cross-infections, (3) utilized systems of sterilization of the instrumentation and (4) behavioural and protecting rules for the staff; (b) use of the biological test to control the sterilization by autoclave and chemical analysis of the disinfecting solutions and (c) research of the indicators of bacterial contamination in indoor air, in the air and in the water of the dental unit and on the surfaces subject to the fall of the aerosol created by the dental activity (Angelillo et al., 1990).

Till now, 122 out of 170 dental surgeries have been examined.
In this paper we will only deal with the environmental microbiological control, whose introductory data were discussed during the V Congress of Aerobiology, 'Habitat and Health', held in Montecatini in October 1992 (Kumer and Mascis, 1992). On that occasion the need of a standardized technique was felt in order to monitor air quality indoor using, among the others, the following sampling methods: (1) the gravimetric technique on sedimentation plates and successive identification and count of the resulting colonies; (2) The use of the volumetric sampler which gives quantitative data expressed as number of germs/mc of air. We decided to utilize the volumetric SAS sampler and the gravimetric sampler on plate with the aim of comparing the two methods, using suitable statistic tests (Pitzurra and Morlunghi, 1978).

2. Materials and methods

In each dental surgery two air samples were taken with SAS (Surface Air System) one using Trypticase Soy Agar and the other using Mannitol Salt Agar to count the total bacterial and Staphylococci spp. charge, respectively. At the same time two Petri dishes with a diameter of 9 cm were exposed to the air for 6 min close to the dental unit; the plates contained the same cultural media. During the odontoiatric activity, the sampling by SAS, which has a inflow of 180 l of air/min, was carried out for 5 min corresponding to 900 l of air. At the end of the sampling the plates were incubated at 37°C for 24–48 h.

Besides the indoor air microbiological control, the air contained in the syringe of the dental unit was examined, spraying it on Trypticase Soy Agar and Mannitol Salt Agar Plates for 2 min. However, since we do not know the exact value of the flux, we only get qualitative data.

We also carried out controls on those surfaces exposed to the contamination of the aerosol produced during the dental activity (Jewett et al., 1992; Mills et al., 1993).

The bacterial charge on these surfaces was estimated using tampons immersed in 10 ml of physiological sterile solution and accurately smeared on an area of 10 cm² delimited by a special flexible mask. On the whole, 200 tampons were carried out and taken to laboratory where they were placed on selective media to get the Total Bacterial Charge, (Total Coliforms and Staphylococci spp) expressed in c.f.u./cm². Microbiological analyses were carried out by the Health Unit Laboratory, Ferrara, Italy.

3. Results and conclusions

The data of the bacterial and Staphylococcal charges, obtained using the SAS method, are shown in Fig. 1.

Referring to the values of bacterial charge mentioned in literature, the range of 25–125 c.f.u./m³ can be considered 'good' (Table 1).

Then, we went on comparing the two methods of survey used at the same time in 50 dental surgeries during normal activity: since the values present a statistically 'abnormal' distribution, we used the method called Box Whisker (Figs. 2 and 3). The results obtained using the plate-method are 4–5 times lower than

<table>
<thead>
<tr>
<th>Surface Air System (SAS)</th>
<th>Index Microbiol Air c.f.u./m³ air</th>
<th>I.M.A./c.f.u.</th>
<th>Judgement</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–24</td>
<td>0–5</td>
<td>0–5</td>
<td>very good</td>
</tr>
<tr>
<td>25–125</td>
<td>6–25</td>
<td>6–25</td>
<td>good</td>
</tr>
<tr>
<td>126–250</td>
<td>26–50</td>
<td>26–50</td>
<td>mediocre</td>
</tr>
<tr>
<td>251–375</td>
<td>51–70</td>
<td>51–70</td>
<td>bad</td>
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