

A STUDY ON PREVENTION OF HOSPITAL  
INFECTION CONTROL CAUSED BY TOOTH  
PREPARATION DUST IN THE DENTAL CLINIC

Part 1 Preventive Measures Against Environmental  
Pollution in the Dental Clinic Caused by  
Microbial Particles

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Original Article

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Abstract

Tooth preparation dust, an indispensable part of dental treatment, contains bacteria and viruses. In order to examine environmental pollution in the dental clinic during tooth preparation, we monitored microorganism spread by counting colony forming units (CFU) with the "Andersen Microbe Sampler." This test was conducted in a "Clean Booth." Mitis-Sarivarius medium was used to count the oral-streptococcus species. The ability of the "Extra-Oral Vacuum Aspirator (EOVA)" to effectively eliminate contamination was also tested, and the EOVA was found to reduce the spread of oral-streptococci, significantly.

The EOVA was therefore viewed as an effective method for reducing air pollution in the dental clinic, and should be used when treating patients with certain infectious diseases.

Key words: Airborne infectious dust — Tooth preparation — Oral-streptococci —  
Environmental pollution — Measures against hospital infection

INTRODUCTION

Dentists and coworkers are continually exposed to various pathogenic microorganisms in blood, saliva, and contaminated air

when performing procedures such as tooth preparation during dental treatment.

The risk of infection by Hepatitis B, Hepatitis C, and HIV has become a social problem. Dentists have begun to employ

measures such as vaccination against Hepatitis B virus, and wearing rubber gloves, protective glasses, and masks during dental treatment.

In tooth preparation with high-speed air turbines, tooth preparation dust from the patient's mouth is one risk for airborne infections.

Thus, some measures against airborne infectious dust in addition to disinfection and sterilization of hands and instruments are essential for effective prevention of infection in the dental clinic.

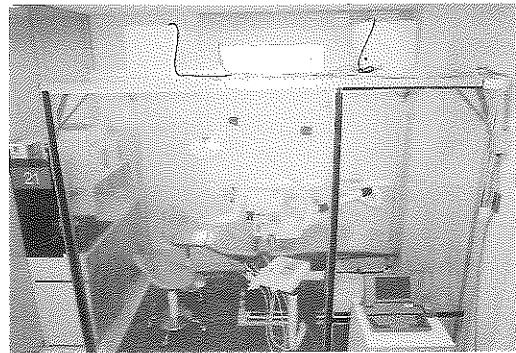


Fig. 1 Isolation equipment (Clean Booth) made by Nippon Kanomax Co., Ltd.

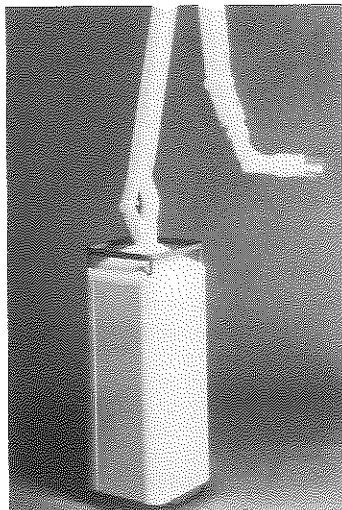


Fig. 2 Extra-Oral Vacuum Aspirator (EOVA) made by Tokyo Giken Co., Ltd. (Free Arm DQ 3.0-S Type)

In order to better understand the properties of the air pollution caused by tooth preparation dust during dental treatment, we examined air contamination by measuring the CFU of oral-streptococci.

We also studied<sup>5-11)</sup> the effectiveness of dental clinic infection control means from the micro-biological point of view by testing the "Clean Booth" (Fig. 1) and the "EOVA" (Fig. 2).

MATERIALS AND METHODS

The Clean Booth was set up in the clinic of the Department of Operative Dentistry in Tokyo Dental College Suidobashi Hospital (Fig. 3). Ten patients had their teeth treated in this Clean Booth (Fig. 4). The contaminat-



Fig. 3 Department of Operative Dentistry in Tokyo Dental College Suidobashi Hospital

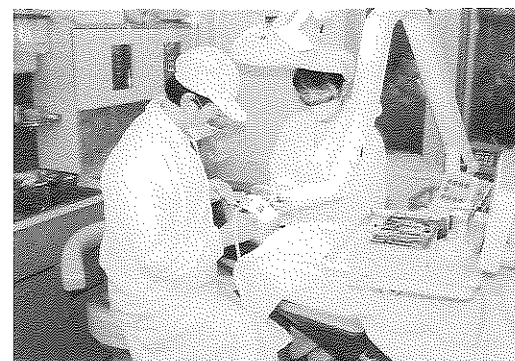


Fig. 4 Tooth preparation treatment in the Clean Booth

ing particles<sup>1)</sup> and the droplets caused by tooth preparation, were monitored with the "Andersen Microbe Sampler" (Fig. 5). The

air contamination was monitored by counting the CFU of oral-streptococci collected by a "55 Plus Monitor" attached to each dentist.

To monitor the dispersion of infectious elements from the patient's mouth toward dentists and coworkers, oral-streptococci adhering to the face guard (protecting the eyes), mask (the mouth), and apron (the chest) were collected and inoculated on Mitis-Salivarius culture medium by the "Stamp-Agar Method."

The effectiveness of EOVA in reducing air pollution was also examined by monitoring the CFU of oral-streptococci.

RESULTS

The distribution of oral-streptococci in various diameter particles monitored with or without EOVA are shown in (Fig. 6). Using EOVA reduced the CFU of oral-streptococci by 94%.

Contamination by particles with diameters of 1.1 ~ 2.1 μm was the most common. The second most prevalent were particles with diameters of 0.65 ~ 1.1 μm.

When measuring the dentist's exposure to oral-streptococci, 27 colonies were collected when the EOVA was not in use, but only 1 colony was collected when the EOVA was used; the elimination rate was 96%.

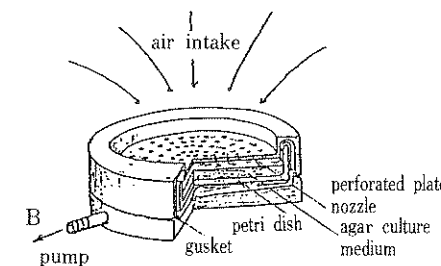
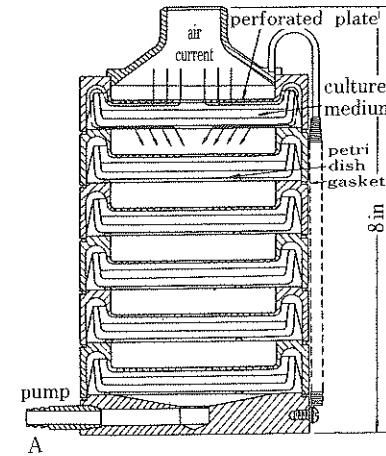


Fig. 5 A: Cross-section of Andersen Microbe Sampler (10-830 Type) made by Nippon Kanomax Co., Ltd.  
B: Perforated plate inside the Andersen Microbe Sampler

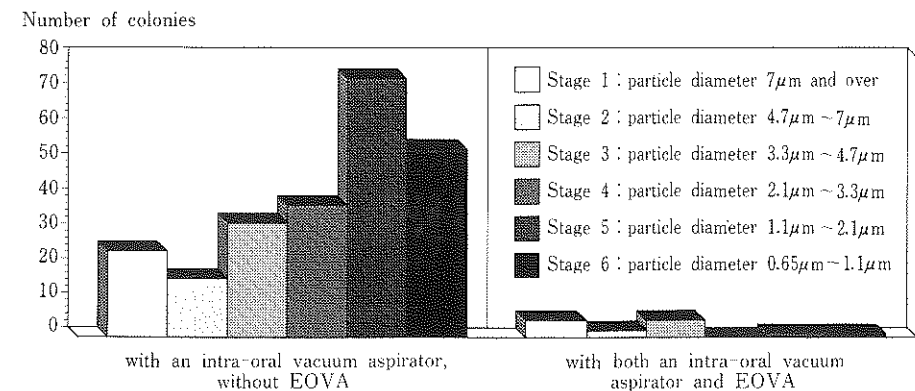


Fig. 6 Distribution of oral-streptococci monitored near the patient's mouth during tooth preparation treatment inside the Clean Booth (monitored with Andersen Microbe Sampler and Mitis Salivarius culture medium)

Dispersion of oral-streptococci to the dentist's face guard, mask, and apron are summarized in (Fig. 7). This test was monitored by the Stamp-Agar Method and Mitis-Salivarius culture medium.

The bacterial cell numbers collected from each site without the EOVA were significantly higher than those with the EOVA. The elimination rate by the EOVA was 91%.

Contamination by oral-streptococci during tooth preparation in an ordinary dental clinic outside the Clean Booth was also stu-

died. We detected bacterial particles in both the airborne dust near the patient's mouth and at the center of the clinic (Fig. 8).

#### DISCUSSION

Monitoring of oral-streptococci in the dental clinic provided a clearer picture of environmental contamination in the clinic during tooth preparation. Further experiments, however, will be needed to determine the

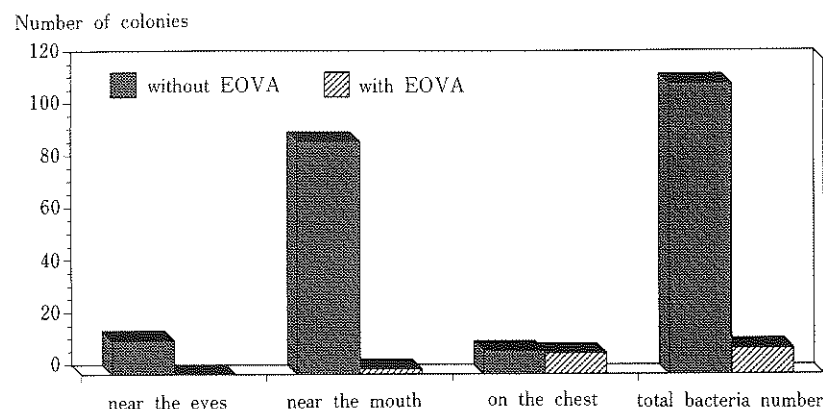


Fig. 7 Dispersion of airborne infectious dust (oral-streptococci) toward the dentist during tooth preparation inside the Clean Booth, with and without EOVA (monitored by the Stamp-Agar Method and Mitis Salivarius culture medium)

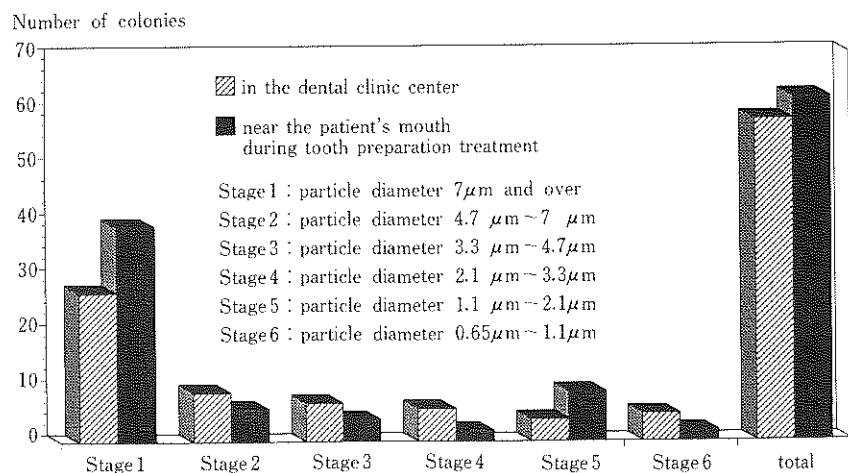


Fig. 8 Distribution of oral-streptococci monitored in the dental clinic outside the Clean Booth at large, and near the patient's mouth during tooth preparation treatment outside the Clean Booth (monitored with Andersen Microbe Sampler and Mitis Salivarius culture medium)

risks of infection through airborne dust containing bacteria and viruses.

The purpose of the Clean Booth, which is manufactured by Tokyo Giken Co., Ltd., is to keep airborne infectious dust out of the clinic.

It is equipped with a large air-purifying device on the ceiling which eliminates as much airborne dust in the clinic as possible and collects tooth preparation dust and the bacteria adhering to the dust.

The concentration of airborne dust inside the Clean Booth at work is set below a certain value (class 10,000). The EOVA (Free Arm DQ 3.0-S Type, Tokyo Giken Co., Ltd.) is designed to collect 99.97% of the dust larger than 0.3 μm with three different filters, thus purifying the exhaust air into the clinic.

The above apparatus was found to be highly effective against environmental pollution in the clinic during dental treatment of patients with certain infectious diseases<sup>2-4)</sup> such as Hepatitis B, Hepatitis C, and HIV.

Accordingly, to prevent the spread of hospital infection in the dental clinic, in addition to disinfection and sterilization of hands and instruments, it is recommended that patients with these infectious diseases undergo tooth preparation treatment in isolated spaces, such as the Clean Booth utilized in the present study.

#### CONCLUSIONS

Oral-streptococci were useful as a monitoring indicator for examining environmental pollution in the clinic caused by tooth preparation dust during dental treatment. Easy detection of oral-streptococci in the air of the clinic indicated a high possibility of infection through the above mentioned dust. The EOVA proved to be highly effective, not only for protecting dentists, but also for preventing air pollution in the clinic. It is recommended that patients with certain infectious diseases should be given treated in a Clean Booth. The need for measures against dust in the dental clinic is strongly suggested.

#### REFERENCES

- 1) Bentley, C.D., Burkhart, N.W., James, J. and Crawford, J.J. (1994). Evaluating spatter and aerosol contamination during dental procedures. *JADA* **125**, 579-584.
- 2) Hirano, N., Suzuki, S., Ide, Y., Noro, A. and Takahashi, K. (1994). The present situation of the infectious disease in Suidobashi Hospital of Tokyo Dental College; Measures of sterilization and disinfection. *Jpn J Dental Practice Administration* **29**, 108-112. (in Japanese)
- 3) Hirano, N., Ohtawa, Y., Sakamoto, T., Nojima, K., Hotta, H., Ide, Y., Takagi, T., Noro, A., Kakizawa, T. and Takahashi, K. (1995). Inquiry into analysis and action to be taken against specific infectious diseases at the Tokyo Dental College Hospital in Suidobashi; (Initial Report) Situation concerning the use of the S.I.C. room. *Shikwa Gakuho* **95**, 141-147. (in Japanese)
- 4) Honma, M., Ichihashi, H., Matumoti, K., Togashi, T., Inuyama, Y., Yoshioka, H. and Wagatsuma, T. (1989). Special issue; Common cold syndrome. *J Jpn Medi Ass* **101**, 409-446. (in Japanese)
- 5) Noro, A., Mori, R., Fujiwara, E., Makiishi, T., Takahashi, K. and Ishikawa, T. (1992). Study on observations of the working environment in dental treatment rooms and analysis and effects of teeth grinding dusts; Part 1. Investigation of airborne dusts in treatment rooms of three dental hospitals belong to Tokyo Dental College. *Jpn J Conservative Denti* **35**, 1059-1064. (in Japanese)
- 6) Noro, A., Fujiwara, E., Mori, R., Makiishi, T., Takahashi, K. and Ishikawa, T. (1992). Study on observations of the working environment in dental treatment rooms and analysis and effects of teeth grinding dusts; Part 2. The personal exposure volume of respirable dusts in dental treatment rooms and analysis of respirable dusts using an X-ray Microanalyser. *Jpn J Conservative Dent* **35**, 1287-1294. (in Japanese)
- 7) Noro, A., Takahashi, E., Mori, R., Makiishi, T., Takahashi, K. and Ishikawa, T. (1993). Study on observations of the working environment in dental treatment rooms and analysis and effects of teeth grinding dusts; Part 3. Investigation of airborne dusts in the new Suidobashi Dental Hospital, and private dental offices; The circumstances of teeth grinding dusts under any kind of conditions. *Jpn J Conservative Dentistry* **36**, 5, 1496-1507. (in Japanese)
- 8) Suyama, Y., Ozaki, T., Takaku, S., Fukuzawa,

- Y., Mochizuki, H., Noro, A., Takahashi, E., Yoshida, S., Takahashi, K. and Ishii, T. (1995). Study on environmental pollution caused by infectious aerosol produced by dental treatment and a measure against infection. *J Dental Health* **45**, 612-613. (in Japanese)
- 9) Suyama, Y., Ozaki, T., Takaku, S., Fukuzawa, Y., Mochizuki, H., Ishii, T. and Yoshida, S. (1995). Eliminating effects of an air purifier on infectants during dental procedures. *Bull Tokyo dent Coll* **36**, 27-31.
- 10) Takahashi, K. and Noro, A. (1993). Study on the working environment in the dental clinic, on airborne dust in clinics, and on analysis of inhalant dust. *J Tokyo Dental Association* **41**, 602-614. (in Japanese)
- 11) Noro, A., Yanaka, N., Takahashi, K., Ishikawa, T., Ogino, J., Takahashi, E. and Suyama, Y. (1995). A study on prevention of hospital infection control caused by tooth preparation dust in the dental clinic; Part 1. Preventive measures against environmental pollution in the dental clinic caused by microbial particles. *Jpn J Conservative Dentistry* **38**, 6, 1549-1561. (in Japanese)

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