

Air Purification and Bacterial Reduction Efficacy of the PURE BREEZE HEPA Air Purifier when used as a Whole Office Solution

J.A. Molinari, Ph.D., and D. Graham, B.A.

Purpose:

To compare the bacterial load reduction capabilities of the **PURE BREEZE HEPA Air Purifier** when used in a dental practice to an equal time period when no air purification is in use in the same dental practice.

Challenge Device: The **PURE BREEZE HEPA Air Purifier** is a portable air purifier designed to filter the air of dust, chemicals, and biological hazards. The **PURE BREEZE HEPA Air Purifier** has a laboratory grade, four stage HEPA air filtration system with three speed options to clean up to 1000 square feet.

Experimental Design:

MATERIALS:

1. Four **PURE BREEZE HEPA Air Purifiers** (Vaniman Manufacturing Co.)
2. Three SAS Super 180 Bioaerosol Samplers
3. TSA with Lecithin and Poly 90 Contact Plates
4. Patient volunteers
5. Four licensed dental professional volunteers

METHODS:

Sampling occurred during normal office hours of the chosen dental practice on the Monday, Tuesday, and Wednesday of two separate weeks. During the first week of testing no air purification was utilized. During the second week of testing four **PURE BREEZE HEPA Air Purifiers** were utilized and set to high. Control samples were taken on the Friday of both weeks when the office was closed. For each of the six total testing days and two control sampling days, samples were taken consistently at three locations within the dental practice three times a day. The first sample was taken each day at 10 am, the second at 1 pm, and the third at 4 pm. Sampling location A was at the reception desk, location B was halfway down the main hallway between the hygiene operatories and sanitation, and location C was in the back of the main hallway just outside of the dentist's operatories (Fig. 1). The number and positioning of the **PURE BREEZE HEPA Air Purifiers** was pre-determined through a custom air exchange analysis performed by *Vaniman Manufacturing Co.* (Fig. 2). The air exchange analysis determined the number of air changes needed per hour for the specified space. There was one week of normal operation in the dental practice between the two testing weeks. The two testing weeks were comprised of similar and comparable hours and operations within the dental practice. All sampling days were comprised of aerosol generating procedures in both the hygiene and doctor operatories. Inside and outside temperatures were recorded during each sampling time, as well as the number of personnel and patients within the dental practice. Each sample was performed using a SAS Super 180 Bioaerosol Sampler with a TSA with Lecithin and Poly 90 Contact Plate embedded inside. The bioaerosol sampler pulls in 1000L of air in 5.5 minutes onto the embedded agar plate. After each sample, the exposed TSA with Lecithin and Poly 90 Contact Plates were immediately processed and incubated at 37°C for 48 hours. Microbial growth was then quantified, analyzed, and recorded for each sampling plate.

Device: Bioaerosol Sampler



Device: PURE BREEZE HEPA Air Purifier



Figure 1. Ceiling Plan - HVAC & Lighting

SCALE: 3/16" = 1'-0"

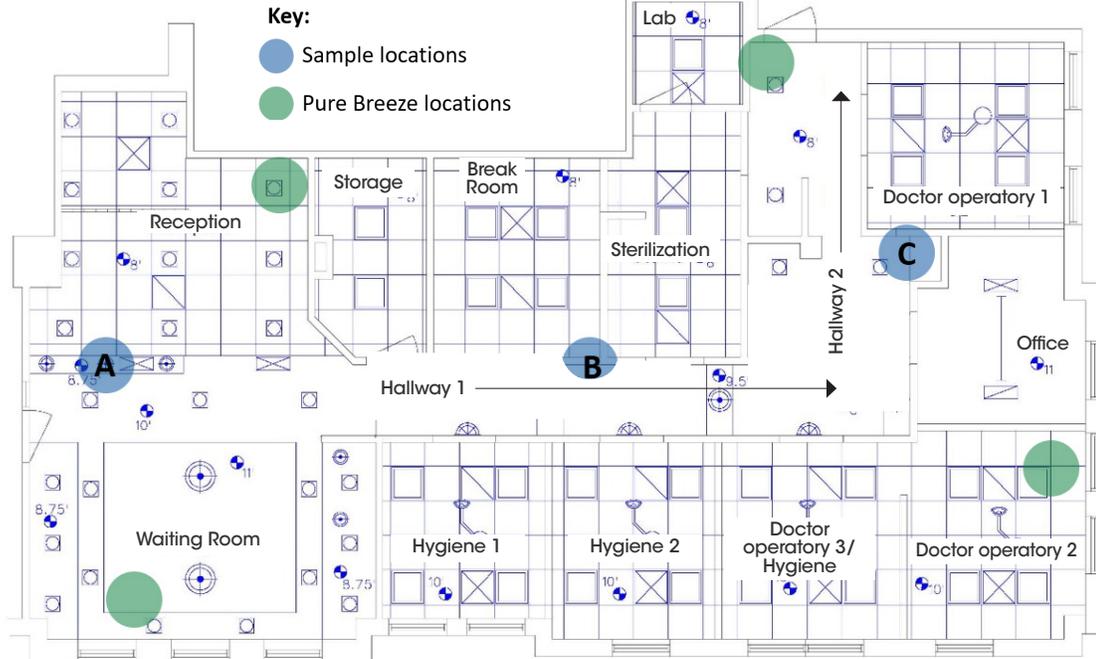


Figure 2.

| Room | Total Air Volume (cu. sq. ft.) | Recommended ACH |
|--|-----------------------------------|-----------------|
| Waiting Room | 3333 | 8 |
| Reception | 1612 | 8 |
| Hallway 1 | 940 | 8 |
| Storage | 609 | 6 |
| Break Room | 875 | 8 |
| Sterilization | 616 | 10 |
| Lab | 287 | 6 |
| Doctor Op 1 | 1215 | 6 |
| Office | 994 | 8 |
| Hallway 2 | 1107 | 8 |
| Doctor Op 2 | 1186 | 6 |
| Doctor Op 3 | 1226 | 6 |
| Hygiene 2 | 1064 | 6 |
| Hygiene 1 | 944 | 6 |
| Total volume of air in the entire office | | 118,109 |
| Average recommended ACH total office | | 7.14 |
| Pure Breeze units needed to reach this ACH: | | 4 |

Reception area



Waiting Room



Results:

Data was averaged by sample location within the office. On average the collected bacterial load was lower for all 3 sample locations during the week when the **PURE BREEZE HEPA Air Purifiers** were in use compared to the week when no air purification was utilized (Fig. 3). Averaging all 27 samples for both weeks resulted in a 40% decrease in overall collected bacterial load in the dental practice when using the **PURE BREEZE HEPA Air Purifiers** compared to the week when no air purification was used (Fig. 4). It is important to note that there are two high outliers in the data set of the week without air purification (week 1). Even without these two data points, the data still showed a 10% decrease in bacterial load with the use of the **PURE BREEZE HEPA Air Purifiers**. Without air purification there was a higher standard deviation in the data and higher fluctuations in the collected bacterial loads than in week 2 when the **PURE BREEZE HEPA Air Purifiers** were in use. Overall, the observed trends showed a decrease in bacterial load with the use of the **PURE BREEZE HEPA Air Purifiers**. The control samples showed low CFU (colony forming unit) counts when the office was completely empty for both weeks (Fig. 4). The number of people in the office during each sample was also a recorded variable (Fig. 5).

Figure 3. Collected Bacterial Load in a Dental Practice

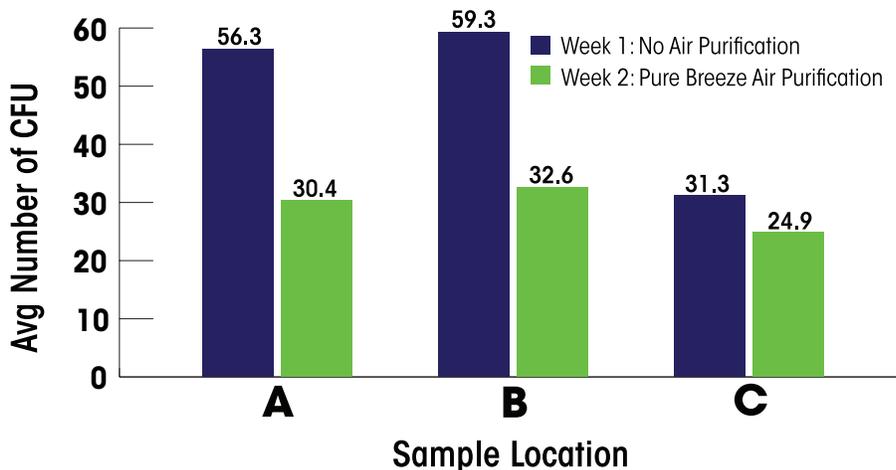


Figure 4.

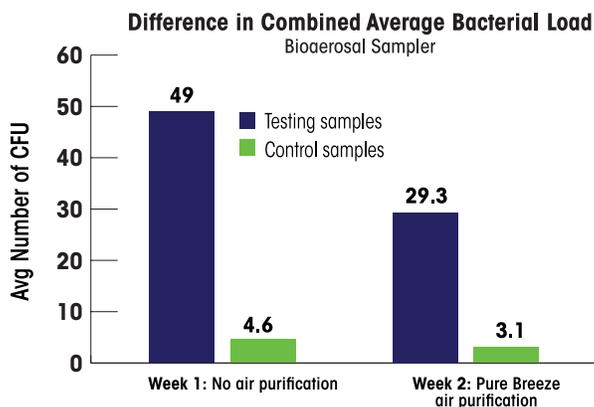
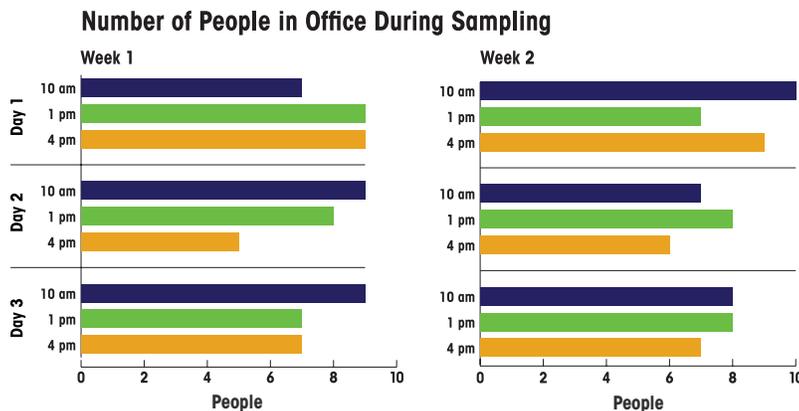


Figure 5.



Discussion:

In this pilot study, the data showed trends of overall bacterial load reduction when **PURE BREEZE HEPA Air Purifiers** were in use in a dental practice compared to having no air purification usage in the same dental practice for an equal time. The purpose of keeping the outliers in the data set was to emphasize that the use of **PURE BREEZE HEPA Air Purifiers** seemed to have an effect on keeping airborne bacterial load from fluctuating higher. It is possible that the use of **PURE BREEZE HEPA Air Purifiers** stopped the bacterial load in the air from dramatically spiking due to certain circumstances that would have normally caused a spike in airborne bacterial load. Bacterial counts were low overall compared to DENTAL ADVISOR'S other research studies, because the bioaerosol samplers were placed outside of the operatories rather than in the operatory in front of the patient's mouth during an aerosol generating procedure. Limitations and variables in this pilot study included a small sample size, varying aerosol generating procedures occurring during sampling, the number of patients being treated at any given time, and/or the natural flow of air in the building via the HVAC system. Future studies could account for these variables and limitations.

Conclusion:

The findings from this study showed trends of reduced airborne bacterial load when the **PURE BREEZE HEPA Air Purifiers** were in use during a busy practice workweek consisting of aerosol generating procedures.