

Reducing Infection Risk and Improving the Patient Experience in our Dental Practice

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At McLean Dental Care, we continuously seek solutions to improve the patient experience and distinguish the practice in a competitive market. We recently evaluated and installed new technology from airPHX | Health that reduces infection risks and improves the patient experience. Feedback from patients and staff has been overwhelmingly positive.

THE PATHOGEN PROBLEM

Even with strict protocols, antimicrobial resistant pathogens such as *Influenza*, *Hepatitis A, B and C* and *H1N1* and similar flus pose ongoing challenges for dental professionals, staff and patients. In a business that serves the public, we continuously risk exposure to viruses afflicting the community. Existing methods to address this challenge have included manual cleaning and personal hygiene such as handwashing and use of air purifiers. These methods have limitations and can be compromised by one contagious patient or staff member inadvertently spreading a virus throughout the practice. It is very expensive to cancel even a single day of appointments because of a sick doctor or dental hygienist – and proactive steps to reduce this risk can have immediate and long-term economic benefits.

airPHX TECHNOLOGY

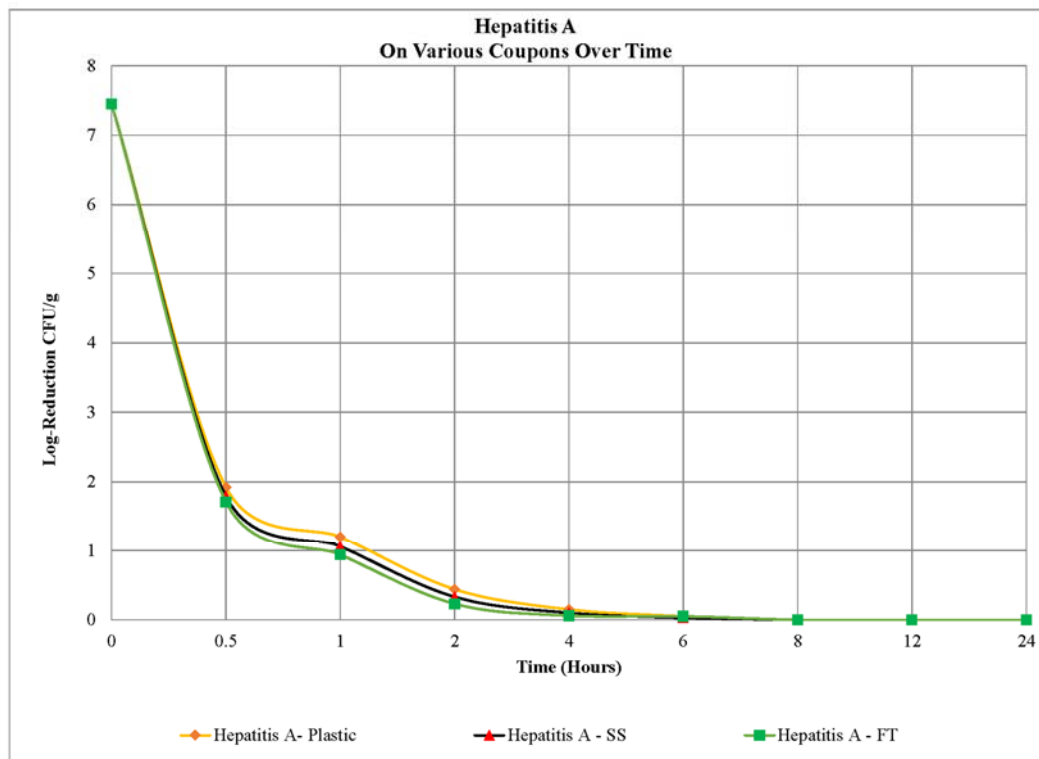
airPHX uses a proprietary atmospheric cold plasma to generate reactive oxygen species (ROS). Deployed extensively in the food safety world, airPHX has miniaturized and adapted this technology for health care and dental practices. The technology works with a two-step process: (1) any airborne organisms are oxidized immediately as they pass through a wall-mounted air handling device; and (2) a small amount of ROS molecules are distributed into our practice where they oxidize and eliminate airborne and surface germs. The airPHX technology works in the background, continuously eliminating viruses, bacteria and molds. The result is a cleaner, healthier practice.

LAB TESTING

Before purchasing this technology, we reviewed lab testing conducted by Dr. Rick Falkenberg, Ph.D. CFA, Scientific Air Solutions, Turlock, California. In a series of tests in 2017, Dr. Falkenberg evaluated the effectiveness of the technology for eliminating a variety of health-care related infection (HAI) pathogens on surfaces. Thirty pathogens were tested including bacteria, viruses and protozoa. Dr. Falkenberg's protocols included: (a) stainless steel, plastic and linoleum coupons inoculated with the actual organisms; (b) exposing the organisms to ROS generated by a portable airPHX unit; and (c) measuring the rate of kill. Of the pathogens evaluated, the

technology resulted in approximately a 4-log reduction in each organism in 30 minutes (from 10,000 organisms to 1) and effectively a total kill after four hours. See Figure 1 below for *Hepatitis A* testing summary, showing almost a 6-log reduction in the organisms within 30 minutes of exposure to the ROS. Almost all other pathogens showed similar trajectories.

Figure 1. Lab test results showing the change in Hepatitis A organisms on stainless steel, plastic and linoleum coupons after exposure to airPHX technology.

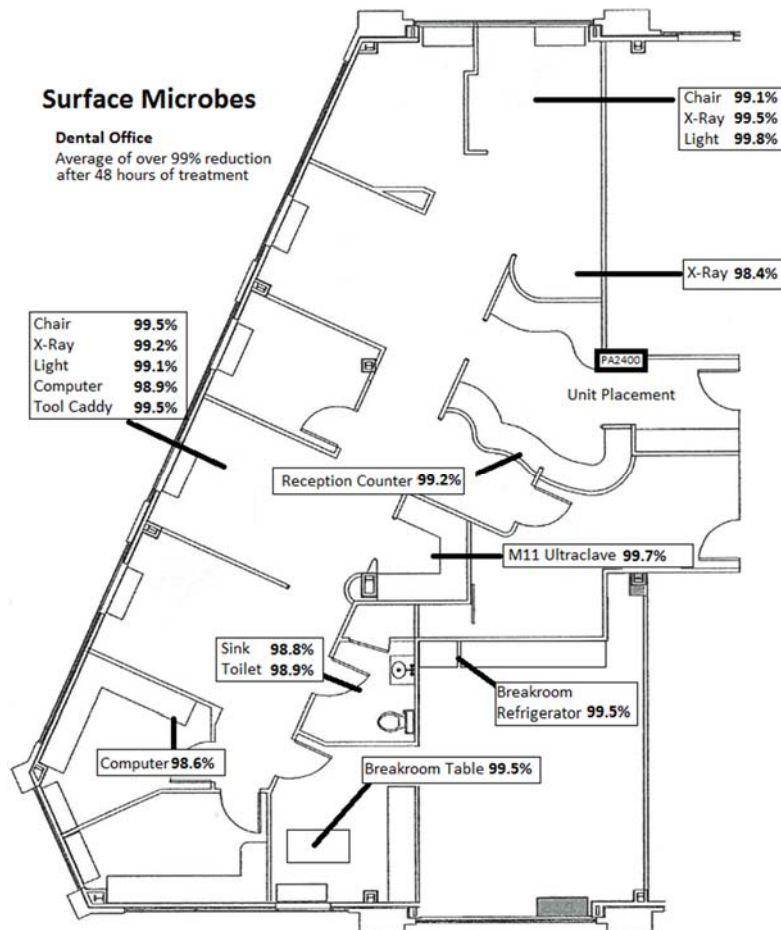


CASE STUDY – OUR PRACTICE

We deployed airPHX in our practice in January 2018, installing a wall mounted unit airPHX unit behind the reception check-in desk. Prior to our purchase decision, we conducted pre-treatment and in-treatment testing – air quality and surface swabs – to confirm the efficacy of the technology in our practice. The initial trial took place over a weekend, where a portable airPHX unit was activated Friday afternoon through Sunday morning. Testing included 17 volumetric air samples at various locations in the practice and 16 surface swabs on several high-touch surfaces, both administrative and treatment areas. Figure 2 provides a summary of testing locations. We forwarded the samples to Dr. Falkenberg’s lab for evaluation, and the results were a dramatic reduction in organisms as measured by colony forming units (CFUs) in the practice

area.

Figure 2. Floor plan diagram showing reductions of germ counts on surfaces in the McLean Dental Care offices.



After we installed the technology on a permanent basis, we are using the unit nightly to thoroughly treat and sanitize our offices, providing a clean and sanitized environment at the beginning of each day. After the permanent installation, we conducted a second round of in-treatment testing to validate efficacy. Shown in Table 1, the airPHX technology resulted in elimination of over 98% of airborne organisms and over 99% of surface germs. Results were realized throughout the practice area and include cleaning rooms, equipment, high-touch services and even the rest rooms and kitchen – clean all over.

TABLE 1. Tabular testing results: McLean Dental Care

Sample Location	Number of Samples	Colony Forming Units (Average) (1)			Initial Percent Reduction	Total Percent Reduction
		3/24/2017 Pre-Treatment	3/26/2017 In-Treatment	4/20/2018 In-Treatment		
Air Samples						
McLean Dental Care (various locations)	17	586	80	12	-86.3%	-98.0%
Exterior	2	3,200	3,083	3,433	-3.7%	7.3%
Surface Samples						
Treatment Area (see Figure)	16	303	9	2.00	-97.0%	-99.3%

(1) CFU/m³ for air samples. CFU/cm² for surface swabs.

CONCLUSIONS

We have been very pleased with the effect of this technology on McLean Dental Care. The testing results showed excellent reductions in pathogen counts throughout the practice. Our patients have noticed a difference in a clean smell, more welcoming environment for patients with respiratory issues and a healthy staff. These benefits more than compensate for the cost of the unit. Going forward, however, we are expecting significant ROI from fewer sick days for doctors and staff – avoiding just two sick days (and the related appointment cancellations) justifies the cost of the equipment.

Protect... Don't Infect!

Scientific Air Solutions



airPHX Companies
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May 25, 2018

Second - In-Treatment Report – McLean Dental Care – Final Report

Summary

Pre-treatment air and contact swab samples were taken 03/24/17, In-treatment samples taken 03/26/17 and 04/20/18 with average results by location for air samples are given in Table #1, and results for contact swab samples are given in Table #2.

Sample Date	Sample	Number of samples	Location	Average cfu/m ³	Average cfu/cm ²	Range	Standard Deviation	Percent Difference
03/24/17	Air	17	Various Locations	586		100/1,100	269.1	-
03/26/17				80		0/167	39.7	86.3
04/20/18				12		0/67	19.6	98.0
03/24/17		2	Exterior	3,200		2,867/3,533	333.3	-
03/26/17				3,083		2,700/3,467	383.3	3.7
04/20/18				3,433		3,300/3,567	133.3	7.3
03/24/17	Contact	16	Various Locations	303	201/386	79.9	-	
03/26/17				9	5/11	1.6	97.0	
04/20/18				2	1/4	0.9	99.3	

Background

Air samples were taken via the MB-2 air sampler, 30 liters per sample throughout the various locations given above with results normalized to colony forming units per cubic meter of air (CFU/m³).

Contact (Swab) Samples were taken via 3M environmental sponge. Samples were taken in a 10 x 10 cm square (approximately 4 inch) and serial diluted onto standard methods media with results normalized to colony forming units per square centimeter of contact surface (CFU/cm²).

Results – Air Samples

Noted below is an overview of the types of airborne organisms found in locations on Table #1 during the **Pre-treatment** air sampling.

Species	Raw Count	Species	Raw Count
<i>Penicillium, aspergillus types</i>	4,350	<i>Cladosporium sphaerospermum</i>	1,660
<i>Aspergillus fumigatus</i>	3,570	<i>Absidia, spp</i>	1,324
<i>Pseudomonas spp</i>	2,400	<i>Penicillium purpurogenum</i>	950
<i>Penicillium brevicompactum</i>	1,950	<i>Basidiospores spp</i>	750

Noted below is an overview of the types of airborne organisms found in locations on Table #1 during the **In-treatment** sampling.

Species	Raw Count	Species	Raw Count
<i>Penicillium, aspergillus types</i>	1,750	<i>Cladosporium sphaerospermum</i>	810
<i>Aspergillus fumigatus</i>	1,400	<i>Absidia, spp</i>	695
<i>Pseudomonas spp</i>	1,290	<i>Penicillium purpurogenum</i>	450
<i>Penicillium brevicompactum</i>	921	<i>Basidiospores spp</i>	370

Scientific Air Solutions



Pre-treatment bioburden from the air samples are 586 cfu/m³ which is > 300 cfu/m³ and is not acceptable and needs corrective action, per the Target Air Quality recommendation below.

In-treatment air samples show a 86.3% reduction to 80 cfu/m³ and now is < 100 cfu/m³ which is considered clean and acceptable.

Second In-treatment air samples show a **98.0%** reduction to **12 cfu/m³** and continues to be < 100 cfu/m³ which is considered **clean and acceptable**.

Target Air Quality

Air quality scale for workplaces, public buildings, schools, and homes is as follows, air with:

- < 100 cfu/m³ is considered **clean and acceptable**.
- 100 to 300 cfu/m³ is **marginal**.
- > 300 cfu/m³ is **not acceptable** and needs corrective action.

In most cases, air quality < 100 cfu/m³ has shown a decrease in the overall bioburden of bacteria/fungi and odors.

Observations - Air

As can be seen outside air samples are adding a significant amount of the bioburden to the Dental facility. Even with this heavy bioburden, the air treatment system continues to reduce the air samples to acceptable levels.

Results – Contact (Swab) Samples

Pre-treatment bioburden from the air samples were 303 cfu/cm² which is > 10 cfu/cm² and considered not acceptable, needs corrective action per the Target Contact Surface Quality recommendation given below.

In-treatment swabs results show a 97.0% reduction to 9 cfu/cm² and now is in the 5 to 10 cfu/cm² which is considered marginal, it is anticipated that continued treatment would further reduce to clean and acceptable.

Second - In-treatment swabs results show a **99.3%** reduction to **2 cfu/cm²** and now is in the < 5 cfu/cm² which is considered **clean and acceptable**.

Target Contact Surface Quality

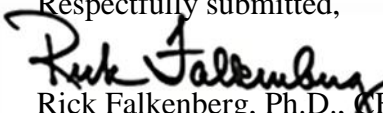
Contact surface quality scale for workplaces, public buildings, schools, and homes are as follows:

- < 45 cfu total or < 1.67-log, or < 5 cfu/cm² is considered **clean and acceptable**.
- 140 to 260 cfu total or 2.15 to 2.41-log, or 5 to 10 cfu/cm² is considered **marginal**.
- > 260 cfu total or > 2.41-log, or > 10 cfu/cm² is considered **not acceptable** and needs corrective action.

In most cases, air quality < 45 cfu total or < 5 cfu/cm² has shown a decrease in the overall bioburden of bacteria/fungi and odors.

Please contact me if there are questions or if further information is needed.

Respectfully submitted,


Rick Falkenberg, Ph.D., AFS
Senior Principal Scientist

Scientific Air Solutions



Table #1
McLean Dental Care
Second – In-treatment Air CFU/m² and Contact Sample Results - CFU/cm²

McLean Dental Care - Second - In-treatment						
Room	Plate Lot No.	Air Sample Location	Air Sample Location	Raw Count	Corrected Count	CFU/m3
Control 1	1013	Control Plate	Unopened	0	0	0
B	1025	1	OR #5	0	0	0
B	1029	2	OR #4	1	1	33
B	1033	3	OR #3	0	0	0
B	1037	4	Consulting Room	0	0	0
B	1041	5	OR #2	0	0	0
B	1045	6	OR #1	1	1	33
B	1049	7	Staff Office	0	0	0
B	1676	8	Storage and Equip	0	0	0
B	1668	9	Reception	1	1	33
B	1660	10	Reception	0	0	0
B	1652	11	Reception	2	2	67
B	1644	12	Waiting Room	0	0	0
B	1636	13	Waiting Room	0	0	0
B	1628	14	Bathroom	1	1	33
B	1620	15	Breakroom	0	0	0
B	1612	16	Breakroom	0	0	0
B	1604	17	Staff Office	0	0	0
B	1017	Exterior - 1	Ext	80	99	3,300
B	1021	2	Ext	85	107	3,567

Avg 12
Low 0
High 67
SD 19.6

Avg 3,433
Low 3,300
High 3,567
SD 133.3

Total Adjusted Raw Count **212**
Total CFU/m3 **7,067**

Room	Swab Lot No.	Plate Number	Surface Swab Sample Location	10x10x10 cm	Raw Count	CFU/cm2
Control 1		10	Control swab	0	0	0
MD		1	Chair @1 Opt5	10x10x10	210	2
MD		2	Xray @ 1 Op5	10x10x10	150	2
MD		3	Light @1 Opt 5	10x10x10	100	1
MD		4	PC-1000 Opt 5	10x10x10	330	3
MD		5	Chair @5 Opt2	10x10x10	120	1
MD		6	Xray @ 5 Op2	10x10x10	215	2
MD		7	Light @ 5 Opt 2	10x10x10	275	3
MD		8	Computer @5 Opt2	10x10x10	420	4
MD		9	Tool Caddy @5 Opt 2	10x10x10	150	2
MD		10	M11 Ultraclave San	10x10x10	90	1
MD		11	Toilet Bath @14	10x10x10	210	2
MD		12	Sink Bath @14	10x10x10	320	3
MD		13	Table Breakroom @15	10x10x10	185	2
MD		14	Fridge Breakroom @16	10x10x10	200	2
MD		15	Reception Counter	10x10x10	210	2
MD		16	Keyboard + Mouse @7	10x10x10	310	3

Avg 2
Low 1
High 4
SD 0.9

Total Adjusted Raw Count **3,495**
Total CFU/cm2 **35**

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Table #2
McLean Dental Care
In-treatment Air CFU/m² and Contact Sample Results - CFU/cm²

McLean Dental Care - In-treatment						
Room	Plate Lot No.	Air Sample Location	Air Sample Location	Raw Count	Corrected Count	CFU/m ³
Control 1	1013	Control Plate	Unopened	0	0	0
B	1025	1	OR #5	2	2	67
B	1029	2	OR #4	2	2	67
B	1033	3	OR #3	0	0	0
B	1037	4	Consulting Room	2	2	67
B	1041	5	OR #2	2	2	67
B	1045	6	OR #1	3	3	100
B	1049	7	Staff Office	4	4	133
B	1676	8	Storage and Equip	2	2	67
B	1668	9	Reception	5	5	167
B	1660	10	Reception	2	2	67
B	1652	11	Reception	4	4	133
B	1644	12	Waiting Room	2	2	67
B	1636	13	Waiting Room	5	5	167
B	1628	14	Bathroom	2	2	67
B	1620	15	Breakroom	4	4	133
B	1612	16	Breakroom	0	0	0
B	1604	17	Staff Office	0	0	0
B	1017	Exterior - 1	Ext	71	86	2,867
B	1021	2	Ext	84	106	3,533

Avg 80
 Low 0
 High 167
 SD 51.2

Avg 3,200
 Low 2,867
 High 3,533
 SD 333.3

Total Adjusted Raw Count **233**
 Total CFU/m³ **7,767**

Room	Swab Lot No.	Plate Number	Surface Swab Sample Location	10x10x10 cm	Raw Count	CFU/cm ²
Control 1		10	Control swab	0	0	0
MD		1	Chair @1 Opt5	10x10x10	875	9
MD		2	Xray @ 1 Op5	10x10x10	500	5
MD		3	Light @1 Opt 5	10x10x10	800	8
MD		4	PC-1000 Opt 5	10x10x10	1,000	10
MD		5	Chair @5 Opt2	10x10x10	650	7
MD		6	Xray @ 5 Op2	10x10x10	980	10
MD		7	Light @ 5 Opt 2	10x10x10	890	9
MD		8	Computer @5 Opt2	10x10x10	1,100	11
MD		9	Tool Caddy @5 Opt 2	10x10x10	875	9
MD		10	M11 Ultraclave San	10x10x10	890	9
MD		11	Toilet Bath @14	10x10x10	1,000	10
MD		12	Sink Bath @14	10x10x10	800	8
MD		13	Table Breakroom @15	10x10x10	900	9
MD		14	Fridge Breakroom @16	10x10x10	1,000	10
MD		15	Reception Counter	10x10x10	870	9
MD		16	Keyboard + Mouse @7	10x10x10	575	6

Avg 9
 Low 5
 High 11
 SD 1.6

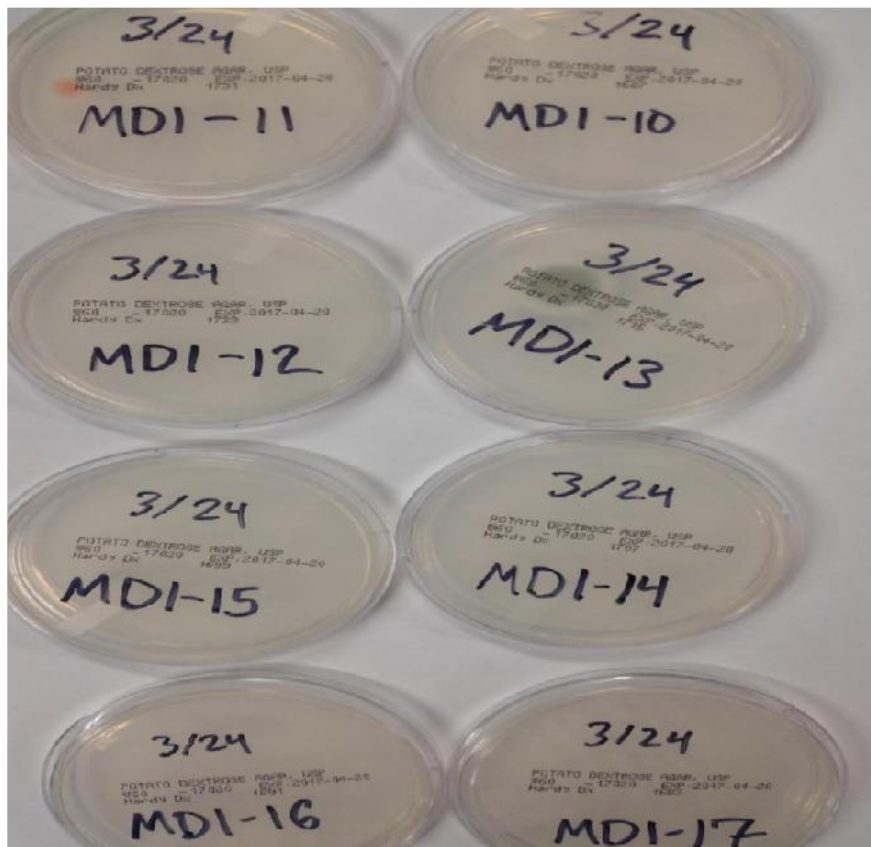
Total Adjusted Raw Count **13,705**
 Total CFU/cm² **137**

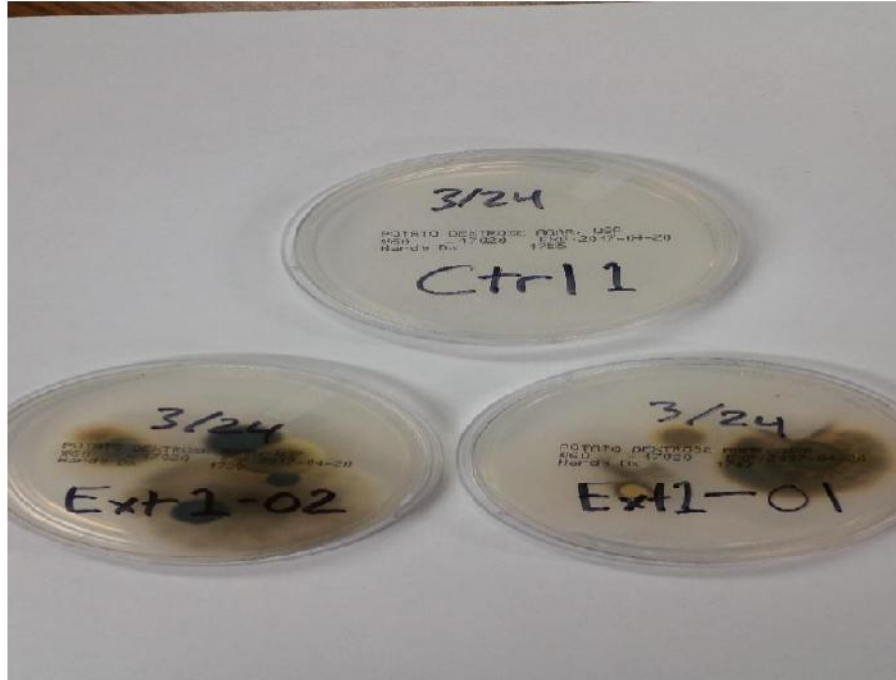


Table #3
McLean Dental Care
Pre and In-treatment and Second In-treatment Pictures

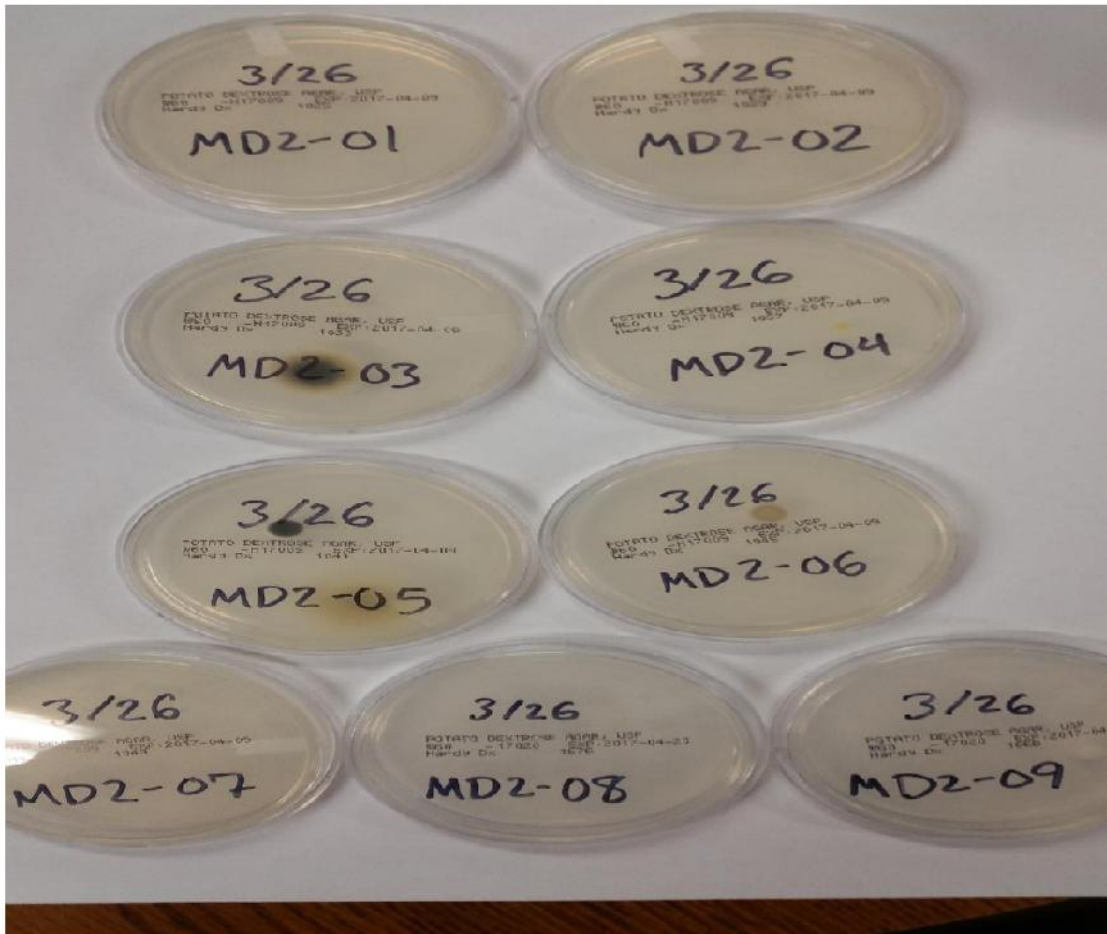


Pre-treatment

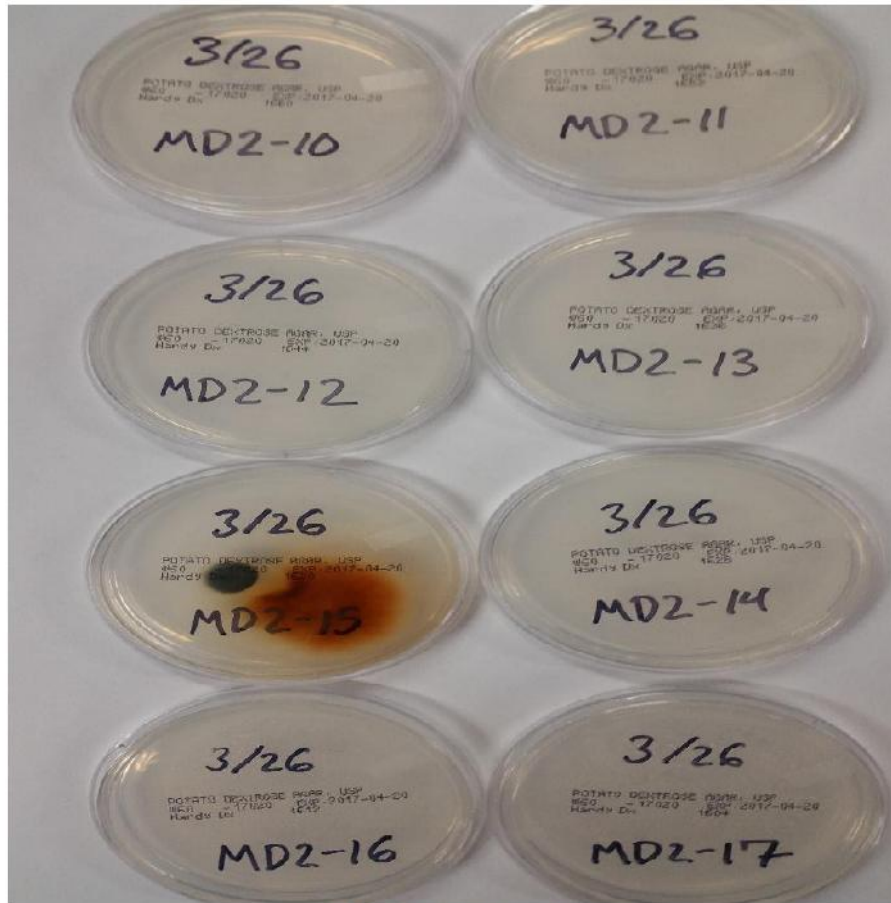




Pre-treatment



Post Treatment



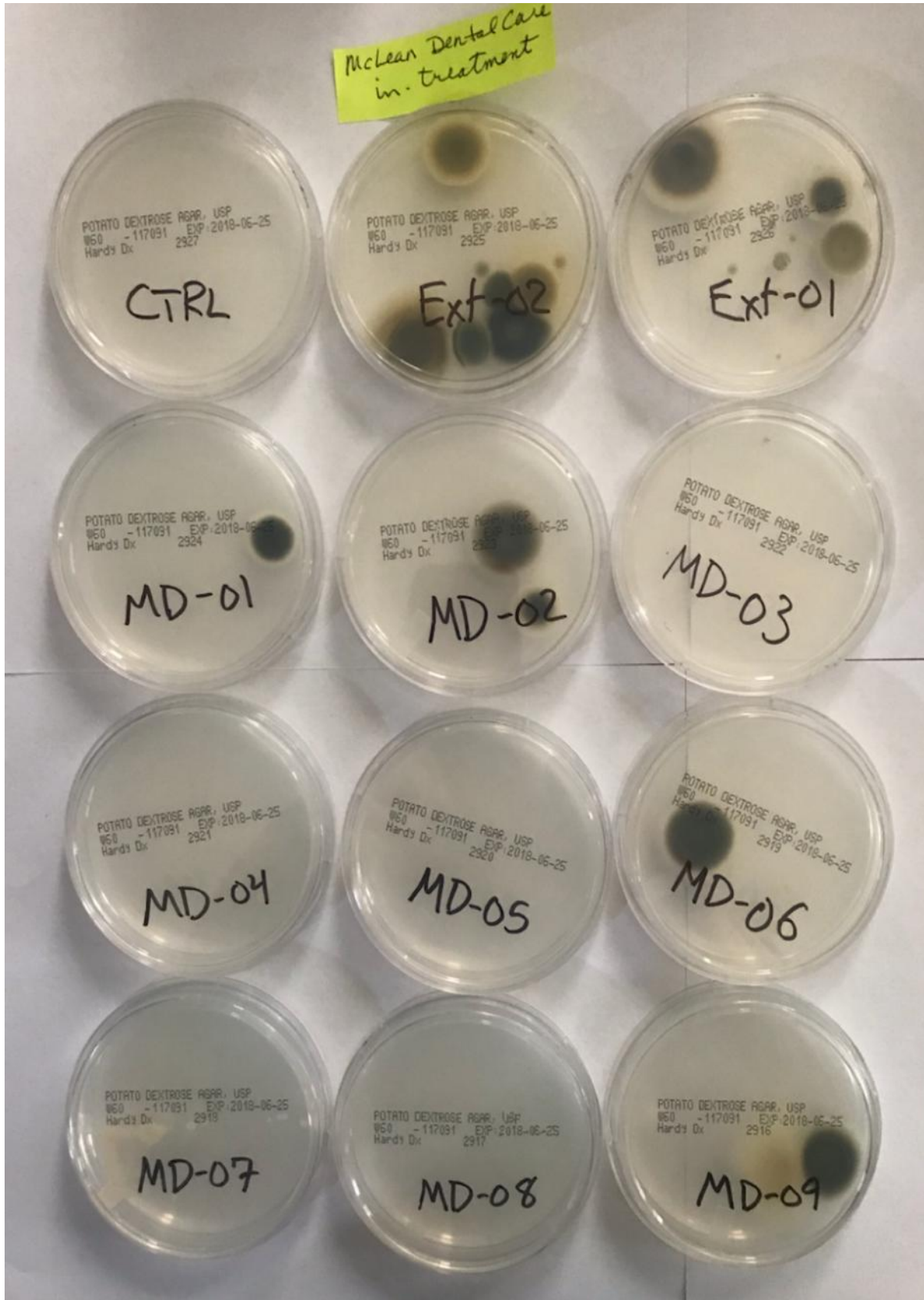
Post Treatment



Post Treatment

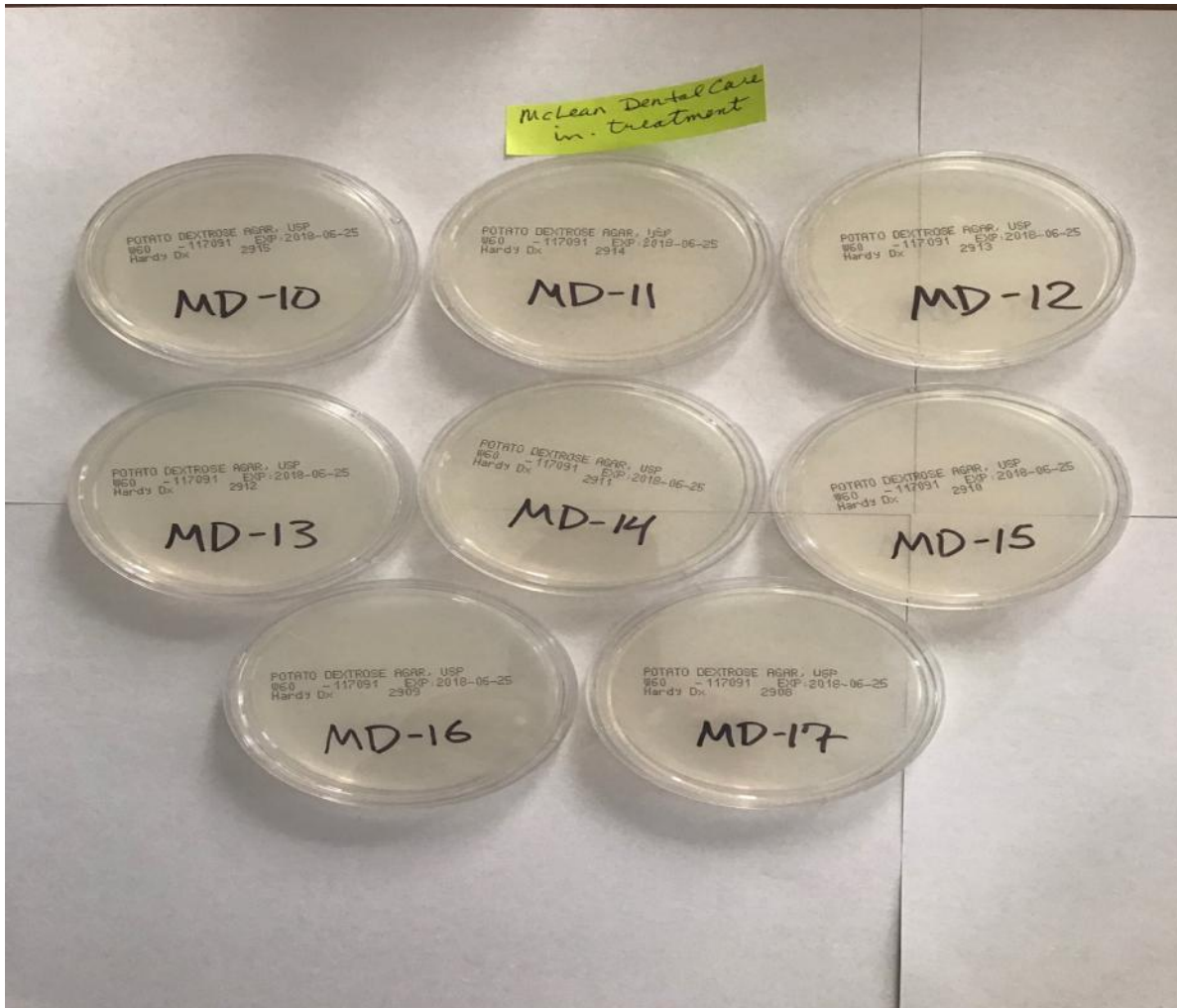


Second – In-treatment Pictures





Second – In-treatment Pictures



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