Efficacy of an Extroral Suction System in Reducing Aerosol Contamination

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Outline

- Background
- Objective
- Materials and Methods
- Results
- Discussion

Background

- Ongoing worldwide COVID-19 pandemic
  - Predominantly respiratory mode of infection
- Routine production of contaminated aerosols during dental procedures
  - Transmit HIV, TB, SARS, measles, influenza, Legionnaire's disease, hepatitis (Cottone et al. 1996, Gruninger et al. 1992)
- Significant concerns amongst the public regarding the safety of dental procedures

Background

- Infection control practices in dentistry
  - Standard Precautions
    - Immunization, hand washing, personal protective equipment, sterilization/disinfection
  - Rubber dam
    - Eliminates 98% of microbial contamination (Harrel 1998)
  - Evacuators or low-volume suction
    - Neither reduced aerosols during ultrasonic scaling effectively (Holloman et al. 2015)

Background

- Previous studies support that extraoral scavenging (EOS) devices and air purifiers reduce dental aerosol contamination
- New paradigm: high-volume extraoral suction (EOS) with high-efficiency particulate air (HEPA) filtration
  - Zhao et al. (2020) reported HEPA air purifier filters removed 83% of aerosols in-vitro, compared to 54% by fine filters
  - Shahdad et al. (2020) found that EOS device usage produced 33% and 76% reduction in mean intensity contamination for the operator and assistant
  - Graetz et al. (2021) further substantiated that an EOS device significantly reduced the number of generated particles during dental treatment

➢ Limited previous studies have tested the clinical effectiveness of newer EOS devices with HEPA filtration in reducing aerosol contamination

PAX2000

- PAX2000 Extraoral Dental Suction System
  - Unique, multi-stage carbon filtration system
  - Medical grade H13 HEPA filtration
  - UV-C bulb light system
  - Kills collected microorganisms >0.3 microns at 99.95% efficiency

Objective

- To evaluate the efficacy of a chairside, extraoral scavenging device (PAX 2000 Extraoral Dental Suction System) on the reduction of aerosol contamination during dental treatment

Null Hypotheses

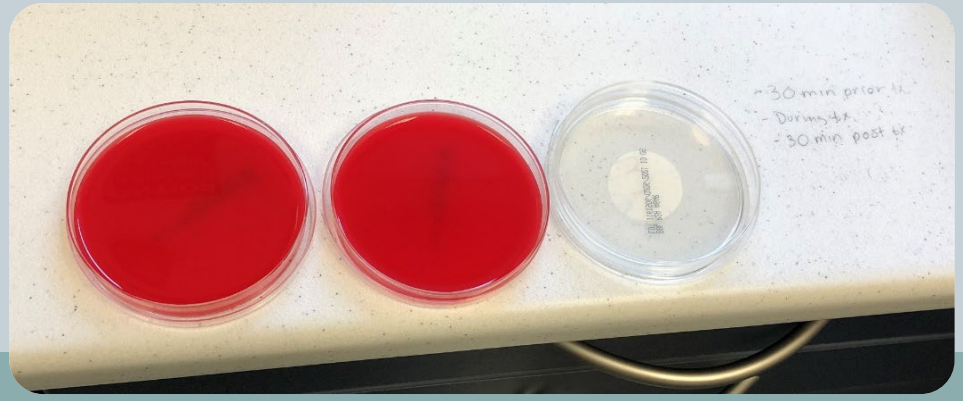
- There will be no difference in microbial load, composition, and spatial distribution in the dental operatory with or without the use of the extra-oral suction device during ultrasonic cleaning of a dental patient

Materials and Methods

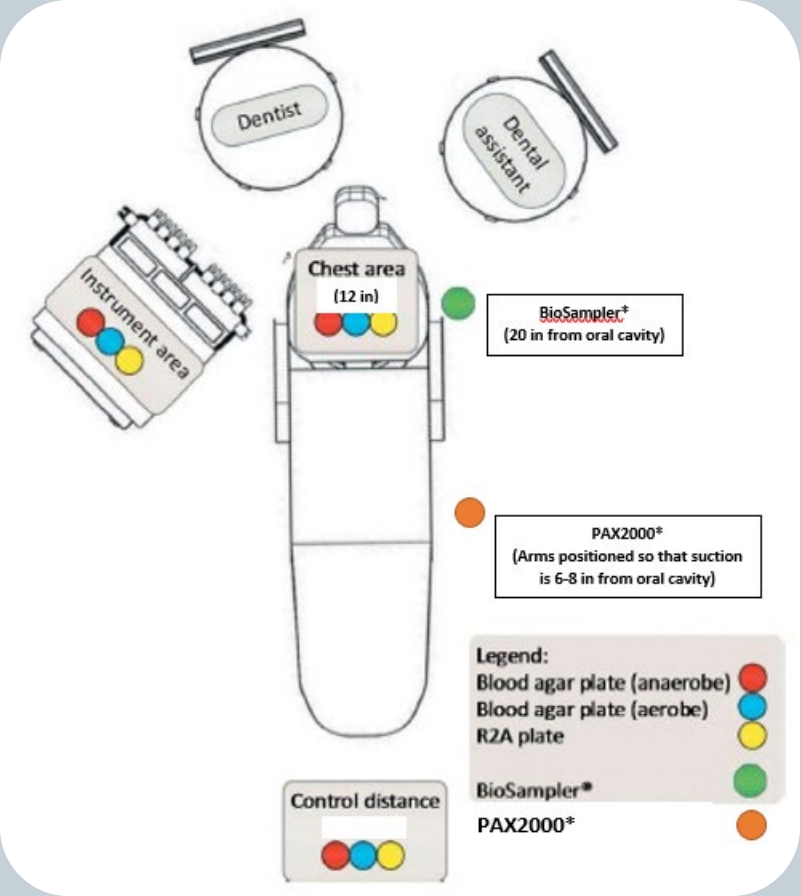
- Ultrasonic scaling was performed on 40 patients treatment-planned for initial or supportive periodontal therapy
  - 2 test groups of 20 patients each; randomized exposure of EOS device during ultrasonic cleaning
  - Exempt human study: Implied consent was obtained from subjects using an informational informed consent letter

Materials and Methods

- Sample collection involved both passive and active sampling
  - Passive sampling utilized petri dishes with blood agar/R2A agar
    - 3 time points
      - Before treatment (30 mins)
      - During treatment
      - After treatment (30 mins)
    - 3 locations
      - Patient chest
      - Instrument tray table
      - Countertop by foot of dental chair (control)

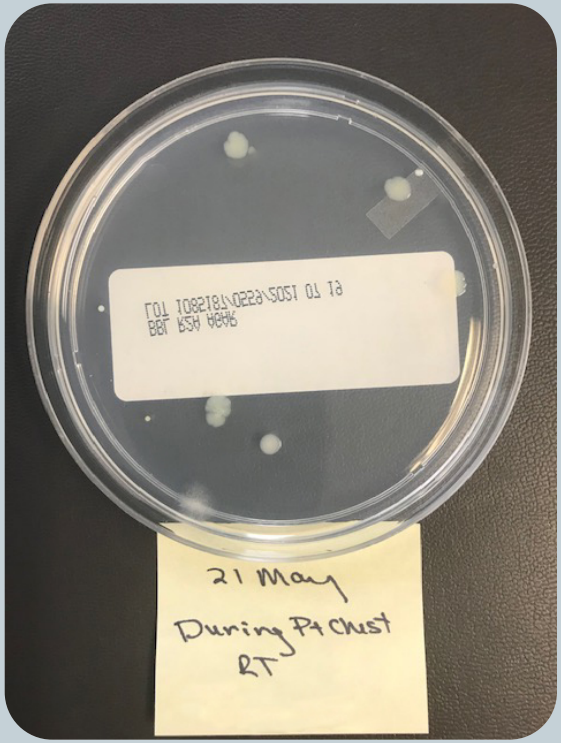


Materials and Methods



Materials and Methods

- Colony forming units were incubated for a week and then quantified per location and timepoint after a week-long incubation period



Data Analysis/Power Analysis

- Outcome data (microbial load, composition, and spatial distribution in the dental operatory) were calculated all locations and timepoints
- Data were analyzed using Mann-Whitney U tests (α=0.05)
- 87% power was achieved by sample size of 20 per test group assuming a large effect size for a 2-sided test

Results

- All collected dental unit water line samples contained 0 CFU/mL
- Lowest mean CFUs were found in samples collected before and after treatment and from samples placed at the control location
- Use of the EOS suction device reduced the number of CFUs during treatment at all locations
  - Statistically significant (p = 0.018) at the patient chest area where the highest microbial load was present during all time points

Time	Location	Colony Forming Units Median (IQR)		
		No Suction Device	Suction Device#	P value
Before	Delivery Unit	1 (3)	1 (2)	0.097
	Patient Chest	1 (2)	1 (2)	0.217
	Patient Foot	1 (2)	0 (1)	0.147
During#	Delivery Unit	4 (3)	3 (3.75)	0.122
	Patient Chest	6 (10.75)	4 (5)	0.018*
	Patient Foot	3 (3)	2 (3)	0.067
After	Delivery Unit	2 (2)	2 (3)	0.842
	Patient Chest	2 (2)	2 (3)	0.156
	Patient Foot	1 (1.75)	2 (3)	0.142

#Suction device was only active during treatment
*Indicates significant difference

Conclusion

- The EOS suction system may serve to reduce aerosol contamination in the clinical dental setting, especially in proximity to the patient's chest region, where most aerosols were generated

Questions?