Aerosolization of *S. mutans* From Stainless Steel Crown Preparations

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BACKGROUND & PURPOSE

- **Limiting bioaerosols is an important goal of infection control in pediatric dentistry**
  - Many human diseases are known to be caused by bioaerosols
    - Influenza, severe acute respiratory syndrome (SARS), tuberculosis, and many others [1, 2]
  - Bacterial cells are **≈1 µm in diameter** and well-retained in the lungs [2,3]
  - Aerosolized particles **<5 µm in diameter** settle less rapidly and disperse furthest through the air [4]
  - Dental isolation systems (Dryshield® [DS], Isolite®) are gaining popularity over traditional dental dams [DD]
    - Limited evidence supports their efficacy at eliminating bioaerosols [5, 6]
- The purpose of this study is to:
  - Investigate bacterial spread via aerosols produced by single stainless-steel crown (SSC) preparations
  - Compare the effectiveness of different isolation methods at eliminating bioaerosols

METHODS

- Melamine pediatric typodont teeth were incubated in tryptic soy broth containing 1% sucrose inoculated with *s. mutans*
- Teeth were prepared for SSCs using 3 different isolation methods:
  - **High-volume evacuation suction [HVE] only,**
  - **HVE with a dental dam [HVE + DD]**
  - **HVE with a Dryshield® [HVE + DS]**
- Blood agar plates placed in 5 locations in closed-room operatory:
  - **Operator faceshield [FS]**
  - **Dental assistant [A]**
  - **Patient [Pt]**
  - **Rear delivery [RD]**
  - **Parent [Pa]**
- Plates collected aerosolized bacteria during each preparation
  - Left open for 10 minutes following each preparation
- Bacterial colonies were counted after incubating each plate for 48 hours at 37°C in 95% air and 5% CO_2
- Effects of isolation method and location on bacteria colony counts were analyzed using generalized estimating equation methods applied to negative binomial regression for count data

Image 1: Experimental setup on simulated patient with opened blood agar plates

Image 2: Melamine teeth coated in lab-grown biofilm

Image 3: HVE with no isolation

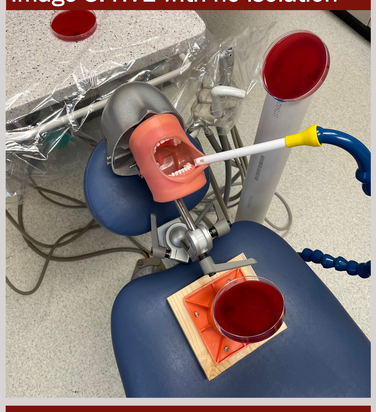
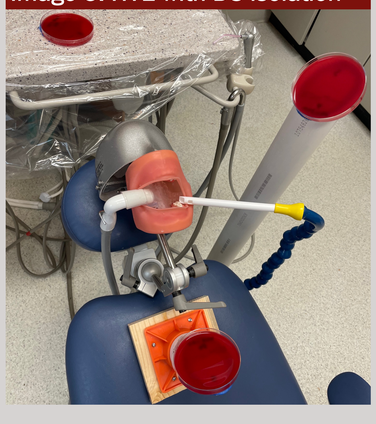


Image 4: HVE with DD isolation

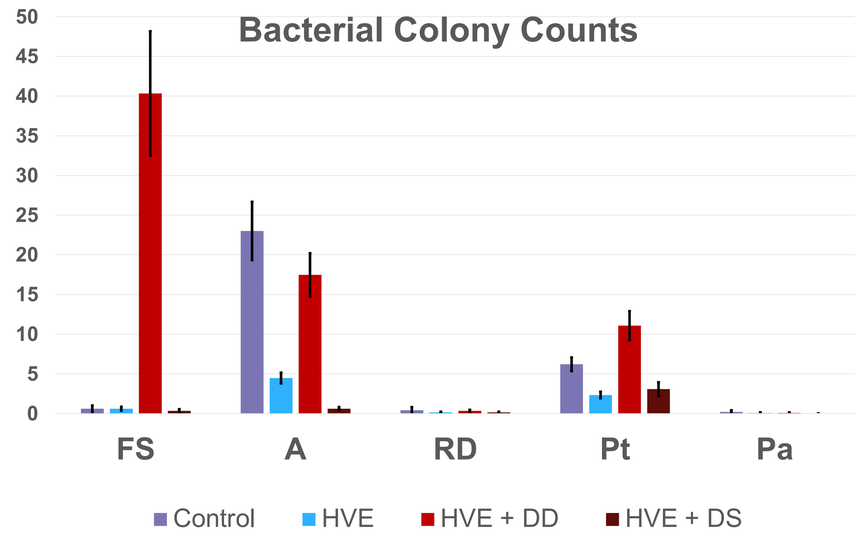
Image 5: HVE with DS isolation



RESULTS

- Bacterial colony counts:
  - HVE+DD > HVE+DS and HVE only at assistant [A], operator face shield [FS] and patient [Pt]
    - **All p<0.003**
  - HVE+DS isolation: **Pt > A, FS, RD, and Pa**
  - HVE+DD: **FS > A > Pt > RD = Pa**
  - No differences between Parent [Pa] or Rear Delivery [RD]

Figure 1: Mean bacterial colony counts with Standard Error



CONCLUSIONS

- HVE+DD was least effective at mitigating bioaerosols near the procedure (FS, A, Pt)
  - Similar to studies from Ahmed et al. [4] and Bentley et al. [7]
- HVE+DS was superior at mitigating bioaerosols than HVE only at A but equal to all other methods at Pt and FS
- Plates at the RD and Pa locations rarely yielded bacterial colonies
- **DD use increases bioaerosols while DS use may effectively limit their spread**

ADDITIONAL PHOTOS

REFERENCES

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