Assessment of Bacterial Presence Among New and "In Use" Resealable Biomaterials Within the Pediatric Dental Clinic

Gavin Banning, DMD and Dr. Kingsley PhD. MPH, BBA

University of Nevada, Las Vegas School of Dental Medicine

Introduction

This study looked at whether reusable dental materials in a pediatric dental clinic can become contaminated with bacteria. Many dental materials, such as flowable composites and root canal fillers, are stored in containers that are opened and used several times. Previous research has shown that dental environments produce aerosols and droplets that can spread bacteria onto nearby surfaces. However, there has been limited research specifically examining whether the containers of these reusable materials become contaminated over time. The purpose of this study was to measure and compare bacterial contamination on new (unused) versus "in use" materials, especially on the dispenser tip (neck) and the inside of the cap, to understand if repeated use increases contamination risk.

Materials and Methods

We collected samples from four commonly used dental biomaterials (NeoPutty, BC Putty, Flowable, and Diapex) in a pediatric dental clinic. Two areas of each container were swabbed: the dispensing tip and the inside of the cap. Both new and used materials were tested, and the level of use was estimated based on how much material had been dispensed. The samples were cultured to grow bacteria, and DNA was extracted and analyzed using quantitative PCR (qPCR) to detect and measure bacterial presence. Specific bacteria, including common oral species, were identified using targeted primers. The researchers also used statistical tests to compare contamination levels between groups and to see if contamination increased with greater use.

The DNA concentration and qPCR cycle thresholds were imported into Microsoft Excel for comparisons between control (positive, negative) and experimental (new, in use) groups using two-tailed Student's t-tests. Mean (average) was calculated and presented with standard deviation (STD). All statistical comparisons were confirmed using ANOVA.

Results

The data from this analysis revealed that the lowest levels of DNA were found among the items sampled at an estimated use of approximately 20% (average 252.76 ng/uL ± 27.22). More moderate levels of DNA were observed from items sampled at an estimated use of approximately 40–50% (average 385.15 ng/uL ± 42.97). The highest levels of DNA were found among items sampled at an estimated use of approximately 80% (average 727.76 ng/uL ± 85.24). The average DNA between samples of the different estimated usages (20%, 40–50%, 80%) were significantly different from one another, $p < 0.0001$ and exhibited a strong, linear correlation between estimated usage and the amount of DNA present $R2 = 0.939$.

Discussion

These data revealed that all of the new or unused items from the clinic were found to have negligible amounts of DNA that were comparable to the negative controls (sterile swabs placed into sterile, autoclaved bacterial culturing medium), which may confirm that proper sterilization and disinfection protocols were followed in the administration of this investigation. However, these results also revealed significant amounts of DNA were found among each of the "in use" or reusable items screened in this study.

Conclusion

This study revealed potential sites for bacterial contamination among common reusable dental biomaterials, also revealing strong associations between the amounts of bacterial DNA and clinical usage. These data strongly suggest that methods for reducing bacterial contamination may need to be expanded to include these surfaces, which may reduce the potential for cross contamination between patients and ensure the highest levels of disinfection for the most effective prevention of patient exposures and highest standards of clinic office hygiene.

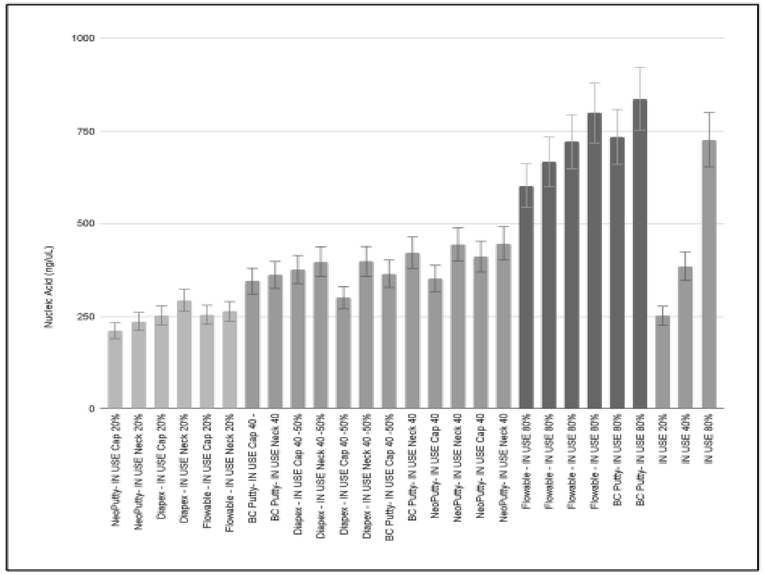

Figure 3. Analysis of DNA from clinic items at different estimated stages of use. The levels of DNA found among the items with an estimated use of approximately 20% (average 252.76 ng/uL ± 27.22) were significantly lower than those with an estimated use of approximately 40–50% (average 385.15 ng/uL ± 42.97, $p = 0.000001$), as well as those at an estimated use of approximately 80% (average 727.76 ng/uL ± 85.24, $p = 0.000001$).

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