



PRO-SYS Toothbrush

Purpose: To evaluate the amount of microbial accumulation found on the *PRO-SYS Toothbrush* handle compared to that of competitor manual toothbrushes.

Experimental Design:

Manual toothbrushes previously used for at least two months were collected from five volunteers. Participants then received a new *PRO-SYS Toothbrush* (Benco) as a 2-month use replacement. The experimental toothbrushes were visually analyzed for debris and photographed. Accumulated bacteria were collected by immersing 4 inches of the handle into 20mL of sterile saline followed by vortexing for 20 seconds. The contaminated saline was diluted 1:10, 1:100, 1:1,000 and 1:10,000, with 1mL of each dilution plated onto trypticase soy agar. Plates were incubated at 37°C for 48-72 hours. Microbial growth was assessed and colony counts were obtained (Table 1). *PRO-SYS Toothbrushes* (Benco) were submitted for testing after 2-months and bacteria loads were tested in the same manner as described above.

Results:

It was readily evident from visual observation of both groups of used toothbrushes that the grooved handles on the manual brushes collected and accumulated high levels of debris. In contrast, the smooth outer surfaces of the *PRO-SYS* toothbrushes did not provide suitable microbial contact, attachment, and collection areas (Figure 1). As further demonstration, only low levels of cultivable bacteria were found on the surfaces of these latter test specimens. Table 1 shows the bacterial culture findings for the individually tested manual and *PRO-SYS* toothbrushes. The differences between the extent and diversity of the bacterial accumulations noted with the two groups of toothbrushes were also apparent when trypticase soy agar cultures of collected specimens were examined. Figures 2 - 3 show representative cultures following incubation of accumulated material taken from used manual toothbrushes, while samples from used *PRO-SYS* toothbrushes are depicted in Figures 4 - 5. Although numerous, diverse, gram-positive and gram-negative bacteria were found with all of the manual toothbrush cultures (Figure 6), few bacteria were isolated from the smooth *PRO-SYS* surfaces. These isolated microorganisms were almost exclusively gram-positive.

Table 1. Bacterial concentrations found on toothbrush handles

Volunteer	Non-PRO-SYS Toothbrush (cfu/mL)	PRO-SYS Toothbrush
1	9,300	63
2	660	26
3	33,000	27
4	106	<1
5	118,000	1
average	33,401	23.4

Results (cont.):

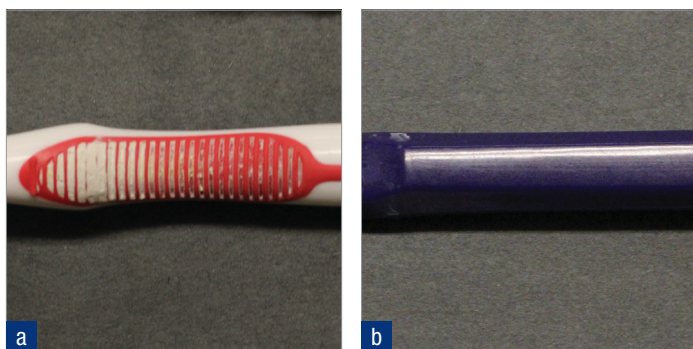


Figure 1. Used a) Non-*PRO-SYS* toothbrush and b) *PRO-SYS* toothbrush

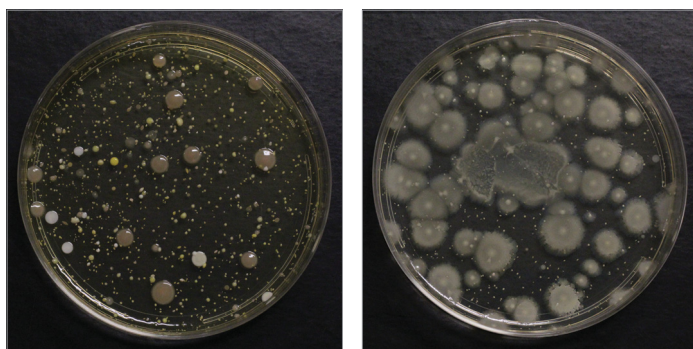


Figure 2 - 3. Representative cultures collected from used non-*PRO-SYS* toothbrushes.

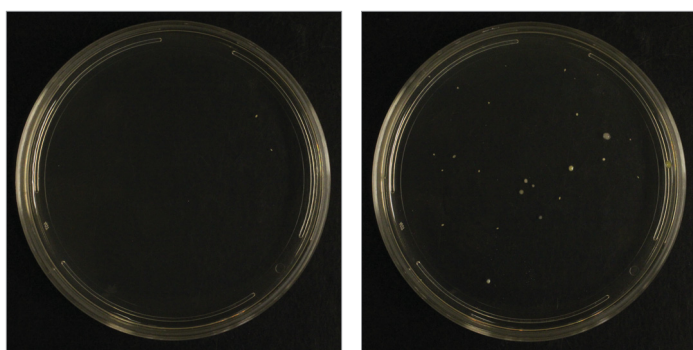


Figure 4 - 5. Representative cultures collected from used *PRO-SYS* toothbrushes.

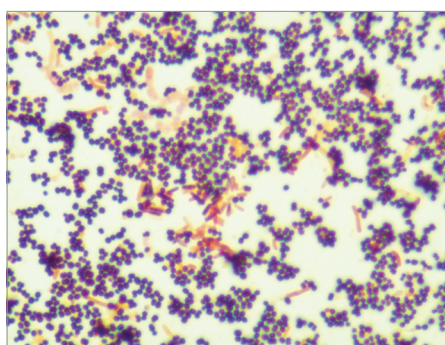


Figure 6. Gram stained sample collected from used non-*PRO-SYS* toothbrushes.

Discussion:

Over time toothbrushes in regular use can accumulate visible debris from the oral cavity, tooth paste, hands, and generated aerosols. The debris can also become heavily colonized and contaminated with a variety of oral and environmental bacteria. One of the factors cited for the microbial contamination has been the surface structure and texture of the toothbrush handle. A grooved, soft, rubber-based coating, such as found on the control manual toothbrushes used in the present study, provides a suitable, and easily accessible, contact surface for debris and microbial accumulation. Bacterial colonization from the user's hand also is facilitated and can add to the microbial loads.

The smooth, hard plastic surface on the handles of the *PRO-SYS* toothbrushes was shown to substantially reduce the extent of debris accumulation and bacterial contamination after prolonged use. Additionally, the design of the handle was able to reduce the role of this type of toothbrush as a possible microbial fomite.

Conclusion:

Microbiological studies comparing microbial contamination on used *PRO-SYS* toothbrushes with that cultured from other manual toothbrushes indicated that there was far less demonstrable accumulated debris and bacteria on the handles of the smooth, hard surface *PRO-SYS* test specimens.