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Research Report

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Number 94– July, 2016

Correlation of *Hu-Friedy Cleaning Monitors* with Instrument Cleaning

Objective:

To investigate the performance of ***Hu-Friedy Cleaning Monitors*** during automated processing of soiled dental instruments.

Materials:

Enzymax Liquid Ultrasonic Cleaner *(Hu-Friedy Mfg.)*
Empower Ultrasonic Cleaning Solution *(Total Care, Inc.)*
Whole sheep blood
Midmark 250 Ultrasonic Unit *(Midmark)*
Hydrim L110W Instrument Washer *(SciCan, Inc.)*
Ultrasonic Cleaning Monitors *(Hu-Friedy Mfg.)*
Washer-Disinfector Cleaning Monitors *(Hu-Friedy Mfg.)*

Methods:

Ultrasonic Testing: Commercially purchased whole sheep blood was used as a representative bioburden to coat instruments for all experiments. ***Enzymax Liquid Ultrasonic Cleane***r and ***Empower Ultrasonic Cleaning Solution*** solutions were prepared fresh daily in distilled water. For each test, representative dental instruments (10 scalers and 10 periodontal probes) were immersed in sheep blood, placed in cassettes, and left in a 50 C oven for 2 hours, allowing applied debris to dry (Figure 1) At the end of this interval instruments were placed in a ***Midmark 250 Ultrasonic Unit*** and cleaned using a 12-minute cycle time for ***Enzymax Liquid Ultrasonic Cleaner,*** and a 10-minute cycle time for ***Empower Ultrasonic Cleaning Solution.*** Two (2) ***Hu-Friedy Ultrasonic Cleaning Monitors*** in their holders were placed into the basket prior to ultrasonic cleaning. Afterwards, treated instruments were briefly rinsed (2-3 seconds) in the cassette under cool water to remove the cleaning solution, and then visually inspected for presence of any remaining debris. Experimental ***Hu-Friedy Ultrasonic Cleaning Monitors*** were

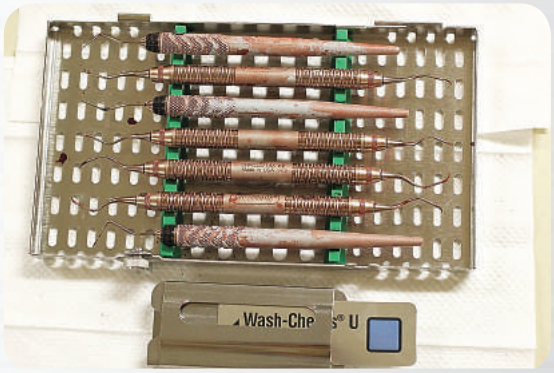

Figure 1. Representative soiled instruments and ***Ultrasonic Cleaning Monitor*** prior to ultrasonic cleaning.

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also observed to assess efficiency of the cleaning cycle. These monitoring devices includes a portion of the surface that has been coated with colored test soil designed to parallel removal of blood and bioburden from contaminated items. Supplemental experiments also focused on exposing soiled instruments to ultrasonic cycle times which were shorter than recommended (1-2 minute cycle times), in order to ascertain the sensitivity of monitors with failed cleaning cycles.

Figure 2. Unused ***Washer-Disinfector Cleaning Monitoring***

Instrument Washer Testing: Dental scalers and periodontal probes were soiled with sheep blood as described above. Instruments were then placed in baskets in a ***Hydrim L110W Instrument Washer*** along with two ***Washer-Disinfector Cleaning Monitors*** (Figure 2). The unit was then set and run at a P3 wash cycle. This was the cycle recommended by *SciCan* for cleaning heavily soiled instruments and cassettes. At the end of the cycle instruments were visually inspected to assess cleaning, and the cleaning monitors were checked to assess removal of all test soil. Subsequent instrument washer experiments used only the shorter "Rinse Hold" cycle, which is not designed to function as a cleaning cycle for contaminated medical instruments.

Results:

Ultrasonic Testing: Results of the 5 prescribed ultrasonic cleaning cycles using ***Enzymax*** (3) and ***Empower*** (2) are shown in Table 1. All test scalers and probes were visibly clean. In addition, when the ***Hu-Friedy Ultrasonic Cleaning Monitors*** placed in the ultrasonic unit were observed, each was found to be devoid of the test soil (Figure 3). This finding indicated a Visually Clean Performance Level (Level 0) for each cycle.

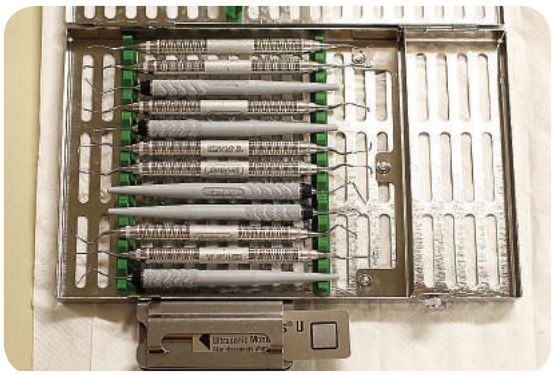

Figure 3. Representative cleaned instruments after a 12-minute ultrasonic cycle. Note complete removal of blue test soil from ***Ultrasonic Monitor strip.***

Table 1. Evaluation of ultrasonic cleaning by visual inspection and ***Ultrasonic Monitors***

Ultrasonic Cycle/Time	Cleaned Scalers	Cleaned Probes	Ultrasonic Monitors
1. Enzymax (12')	10/10	10/10	Level 0
2. Enzymax (12')	10/10	10/10	Level 0
3. Enzymax (12')	10/10	10/10	Level 0
4. Empower (10')	10/10	10/10	Level 0
5. Empower (10')	10/10	10/10	Level 0
Total	50/50	50/50	

Table 2. ***Ultrasonic Cleaning Monitor*** evaluation of instrument cleaning following 1- and 2-minutes cleaning cycles

Ultrasonic Cycle/Time	Wash-Checks
Enzymax (1')	Level 2-3
Enzymax (2')	Level 2-3
Empower (1')	Level 2-3
Empower (2')	Level 2-3

In contrast to the above findings, when soiled instruments and ***Hu-Friedy Ultrasonic Cleaning Monitors*** were exposed to ultrasonic cleaning cycles of only 1-to-2 minute duration, multiple instruments were noted with remaining blood on them. While the number varied from cycle to cycle, at least 2-3 instruments in each load showed traces of blood. In addition, residual soil remained on ***Ultrasonic Cleaning Monitor*** test discs (Table 2; Figure 4). When the color was compared to the Cleaning Levels chart provided by *Hu-Friedy,* it was determined that only Level 2 or Level 3 cleaning performances had been achieved.

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Instrument Washer Testing: A total of 5 test cycles were performed on sheep blood-soiled instruments in a ***Hydrim L110W Instrument Washer***. Of these, instrument cleaning was evaluated using either manufacturer's P3-Heavy Duty Cycle (3 cycles) or the P1-Rinse and Hold cycle (2 cycles). The latter setting is designed to be used to prevent soil from drying in instruments, and is not recommended by the manufacturer to accomplish complete cleaning of instruments. Test results showed that during the P3 cleaning cycles: 1. instruments were visibly clean; and 2. test soil was completely removed from the attached ***Washer-Disinfector Cleaning Monitors*** (Figure 5). In contrast, while instruments appeared to be visibly clean after being exposed to P1-Rinse-Hold cycles, residual soil was noted on the ***Washer-Disinfector Cleaning Monitor*** surfaces. That suggested failed cleaning (Figure 6).

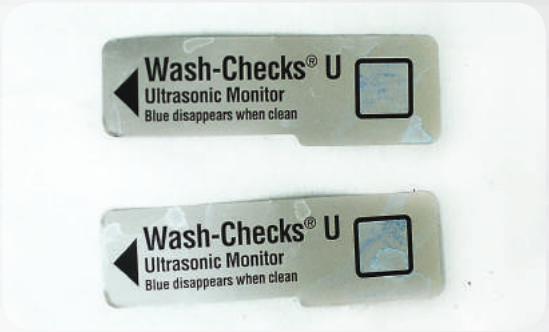

Figure 4. Residual blue test soil on ***Hu-Friedy Ultrasonic Cleaning Monitors*** after blood-soaked instruments were exposed for 1 minute in ultrasonic unit.

Figure 5. Complete removal of red test soil on ***Washer-Disinfector Cleaning Monitor*** after cleaning instruments at ***Hydrim*** P3-Heavy Duty Cleaning Cycle.

Figure 6. Residual red test soil on ***Washer-Disinfector Cleaning Monitor*** after blood-coated instruments were exposed to P1 Rinse-Hold ***Hydrim*** cycle.

Discussion and Summary:

Cleaning of contaminated, reusable instruments prior to heat sterilization is a fundamental first step in all reprocessing procedures. If biological and soil contamination are not removed, remaining debris can interfere with microbial inactivation during a sterilization cycle. The present series of experiments studied a new generation of monitors which use a test soil that mimics bioburden. A successful cleaning process would be shown by removal of all soil from the commercial strip. When ***Hu-Friedy Ultrasonic Cleaning Monitors*** and ***Washer-Disinfector Cleaning Monitors*** were tested in an ultrasonic unit and instrument washer with heavily soiled instruments, respectively, both were able to meet or exceed visual observation findings. Test soil was completely removed during cleaning cycles designed to appropriately clean contaminated instruments; in addition, both monitors indicated failed cleaning when shortened or holding cycles were run. In summary, use of the ***Hu-Friedy Ultrasonic Cleaning Monitors*** and ***Washer-Disinfector Cleaning Monitors*** appeared to provide an effective method for assessing the effectiveness of ultrasonic and instrument washer cleaning processes.

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