Force Testing Comparison of Healthmark CC-230-600 New Brush Head and Olympus 6 mm Brush

Procedure

The two brushes tested were the new CC-230-600 brush head and the equivalent Olympus brush (BW-201T).

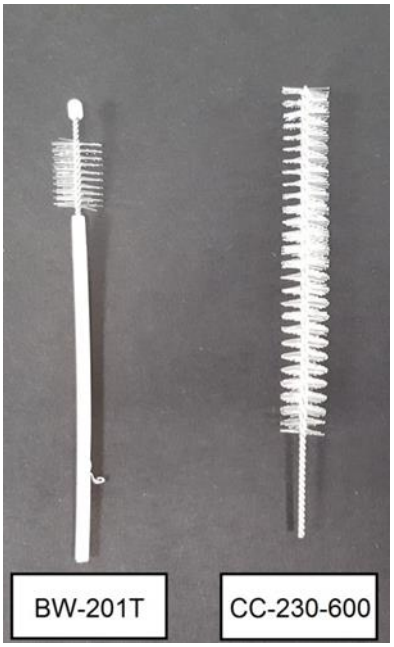

Figure 1 – The two brushes

Brush	Diameter (mm)	Bristle Length (mm)
BW-201T	6	8
New CC-230-600	6	45

Table 1 – The dimensions of each brush

Each brush was run using the standard brush testing in lumen program. The stainless steel lumens used had a diameter of 3 & 4 mm. The program was set to insert and remove the brush from the lumen a total of 3 times. The program was run 5 times for each brush. The data was analyzed and is displayed below:

Brush	Maximum Force Inserting into Lumen (N)	Average Force Inserting into Lumen (N)
BW-201T	6.0763	0.5071
CC-230-600	5.2222	3.4741

Table 2 – The forces required to insert each brush into a 3 mm lumen

Brush	Maximum Force Inserting into Lumen (N)	Average Force Inserting into Lumen (N)
BW-201T	0.4671	0.2491
CC-230-600	4.9865	2.8157

Table 3 – The forces required to insert each brush into a 3 mm lumen

Brush	Maximum Force Pulling out of Lumen (N)	Average Force Pulling out of Lumen (N)
BW-201T	2.2108	0.3692
CC-230-600	4.8930	1.9305

Table 4 – The forces required to pull each brush out of a 3 mm lumen

Brush	Maximum Force Pulling out of Lumen (N)	Average Force Pulling out of Lumen (N)
BW-201T	0.7429	0.2491
CC-230-600	9.4169	3.1894

Table 5 – The forces required to pull each brush out of a 3 mm lumen

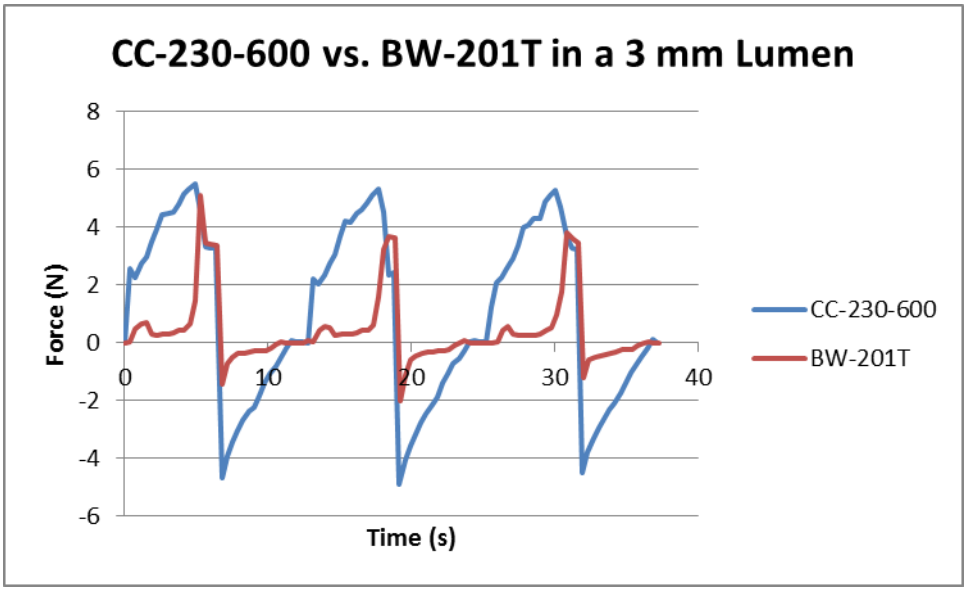

Figure 2 – One program run of each brush graphed for comparison

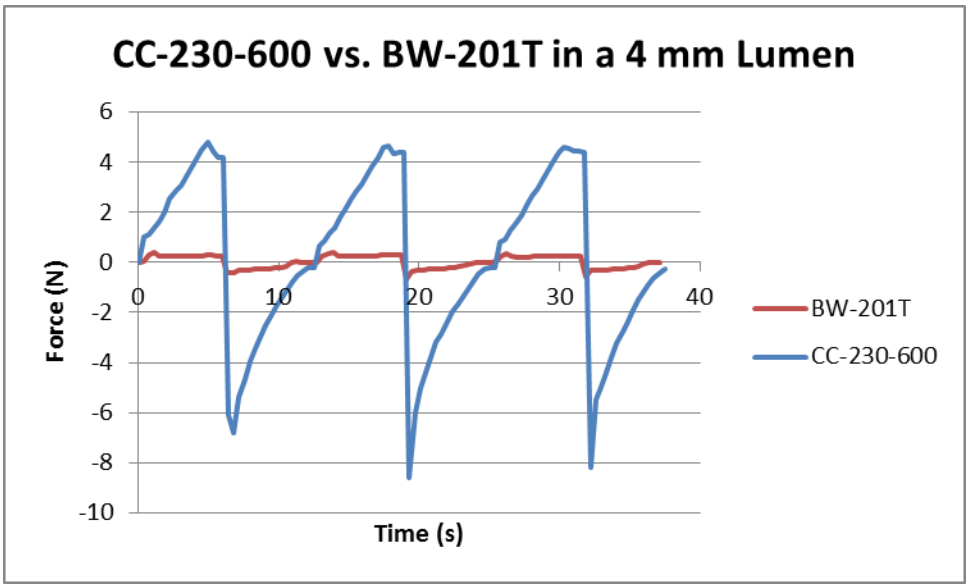

Figure 3 – One program run of each brush graphed for comparison

The ability of each brush to remove soil was tested by soiling 3.175 & 4 mm Teflon tubes and running the standard brush testing in lumen program. The weights were taken at each step to determine soil added and removed. After the brushing program was run, the lumens were flushed with water and air to simulate a real world cleaning scenario.

Brush	Average % of Soil Removed From Brushing	Average % of Soil Removed From Brushing & Flushing

BW-201T	51	99
CC-230-600	50	99

Table 4 – Amount of soil removed with a dry brush in a 3.175 mm lumen

Brush	Average % of Soil Removed From Brushing	Average % of Soil Removed From Brushing & Flushing
BW-201T	47	98
CC-230-600	86	99

Table 5 – Amount of soil removed with a dry brush in a 4 mm lumen

Discussion

The force required to insert or remove a brush from the lumen is associated with the friction of the bristles contacting the surface of the lumen. Therefore, a higher force can be related to more bristle contact with the lumen. More bristle contact and friction can be related to cleaning power, because the bristles would have more opportunities to loosen and remove soil. Comparing the two brushes, they demonstrated similar maximum forces required for insertion in a 3 mm lumen (Table 2), but the Olympus BW-201T had a lower average force during insertion. This is most likely due to the shorter length of bristles along the shaft, creating less friction as the brush runs down into the lumen. The new CC-230-600 required much more force to be inserted and removed from a 4 mm lumen (Tables 3 & 5). Again, this is likely due to the length of bristles along the shaft, which has more contact to the lumen and creates friction. When a brush is removed from the lumen, the bristles will shift direction as the brush is pulled outwards. This creates a peak of force, and the more bristles that are contacting the lumen, the greater this peak will be. Overall, more force is required to insert and remove the new CC-230-600 brush head compared to the Olympus BW-201T. As stated, this greater overall force can be related to more friction and bristle contact. When testing actual soil removal in a 3.175 mm lumen (Table 4), both brushes performed similarly, each having about 50% removal from the brushing alone, and then about 99% removal with flushing the lumen. When comparing soil removal in a 4 mm lumen (Table 5), the CC-230-600 removed nearly twice the amount of soil before the flush, and slightly more after the flush. The data demonstrates that the new CC-230-600 brush head would perform similarly to the Olympus's BW-201T.