

## Comparison of Healthmark and Olympus Elevator Mechanism Brushes:

### Dimensions

Figure 1 – Close-up of the Olympus MAJ-1888 (left) and Healthmark EMB-001 (right) Elevator Mechanism Brushes



Table 1 – Approximate Measurements of Bristle Dimensions

Brush	Length of Bristles Along the Shaft	Diameter of Bristles
MAJ-1888	10 mm	2 mm
EMB-001	10 mm	2 mm

### Force Testing

The force required to insert each brush into the lumen and the force required to remove each brush from the lumen was measured with a Chatillon Ametek Force Tester. Each elevator mechanism brush was tested with a 1 mm internal diameter stainless steel lumen. The brushes were attached to the force tester where a specialized program was run. The program consisted of the brush being inserted into the lumen and pulled out at a constant rate. The program was run 10 times for each brush and the results were averaged below:

Table 2 – Force Measured with a 1 mm Lumen

Brush	Maximum Force Inserting into Lumen (N)	Average Force Inserting into Lumen (N)	Maximum Force Pulling out of Lumen (N)	Average Force Pulling out of Lumen (N)
MAJ-1888	0.503	0.302	0.507	0.191
EMB-001	0.240	0.151	0.365	0.160

The ability of each brush to remove soil was tested by soiling a 1.5 mm Teflon tube 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.

*Table 3 – Amount of soil removed with a dry brush*

Brush	Average % Soil Removed (Brushing)	Average % Soil Removed (Flush)
MAJ-1888	20	35
EMB-001	23	29

### **Discussion**

The force required to insert or remove a brush from the lumen can be related to the cleaning power of the brush. This is related through the relationship of force to friction, which correlates to more contact of the bristles to soils. As demonstrated in *Table 2*, the EMB-001 required less force than the MAJ-001 brush. Due to the very similar bristle length and diameter of each brush, a different factor such as sturdiness of the shaft or stiffness of the bristles must be contributing to the difference. Overall though, the brushes have similar forces required. Although the MAJ-1888 required more force, it was not significantly more. Both brushes required half a newton or less maximum for insertion and removal. Both brushes had similar soil removal: each removed about 20% with a dry brush. After flushing, the MAJ-1888 had more soil removed on average, but it is not significantly more than the EMB-001. The measured forces and soil removal can be correlated to cleaning efficiency, so it can be assumed that both brushes would perform comparably in cleaning scenarios.