GUEST ARTICLE by George, a director of a large hospital laboratory who hasn't done any pipetting in well over 5 years.

My laboratory is substantially fully automated, but manual pipetting still performs a few functions. I have not done any pipetting in well over 5 years, but I recognized this new Differential Pipetting design to be very different and interesting and I took the opportunity to look at it and check it out myself against a couple of manual reference pipettors that we were still using. I wanted to get a feel for this mechanism myself.

The Differential Displacement Pipettor uses two pistons that are approximately 4.0 mm and 4.1 mm in diameter that work together. These pistons are therefore of much greater diameter than the pistons in regular precision pipettors, and can use large seals, which is good for sealing and wear. But when the two pistons move reciprocally in the same chamber, one entering the chamber while the other leaves it, the small difference in their cross sectional area is like that of a very tiny single piston -- exactly like the piston of a 50 µL syringe, to be exact. This reciprocal relative movement therefore gives the same fine resolution and stroke distance that a 50 µL syringe would gave, which is a very precise aspiration. But for dispensing, only one piston moves, without any differential offset from the other, and its large cross section gives a strong air blowout that delivers the samples crisply and apparently cleanly, without needing to go underwater or touch a surface to deliver the sample.

I first ran it against the solid displacement 20 µL pipettor that we use with our osmometer, an Advanced Instruments 3320 Osmometer and its 20 µL solid displacement pipettor. Then I ran it against our Oxford pipettor, a 10-100 µL unit that is set to 20 µL and uses disposable tips. Measurements were made with an Artel PCS photometric system that was brought in for this study. One delivers the sample (PCS range 3 red dye in this case) into an open mouth vial and an automatic vibrating swirl then sloshes the liquid in the vial to capture all the material on the inner walls. I delivered to the Artel vial with our pipettors in the standard delivery manner by touching the tip at an angle to the inside wall of the PCS vial when delivering and dragging away while I dispensed. With the Differential pipettor, I needed only to aim the tip generally at the center of the vial and push the plunger the rest of the way down for the sample to come cleanly off. I do not consider myself a good pipettor and haven't done pipetting in many years, but I probably did the touchoff-and-drag technique with our two regular pipettors at an average level, and the dispensing from the Differential Pipettor was particularly easy.

1st Study: Osmometer fixed solid displacement pipettor vs Differential Pipettor, reusing the same tip for all samples.

	Run 1 20 µL solid displacement Osmometer Pipettor	Run 2 20 µL Differential Pipettor
Mean Volume	20.83 µL	20.30 µL
Absolute inaccuracy	0.83 µL	0.30 µL
Relative inaccuracy	4.17 %	1.51%
Standard deviation	0.597 µL	0.221 µL
CV% precision	2.86 %	1.09 %
Time	12:04 PM	12:18 PM
Temperature deg C	18.9 C	19.4 C
Total points run	13	12
Outside 2SD outliers discarded	1*	0
Points used in final calculation	12	12

*outlier was 14.58 µL, 3.2 SD low. Including it gave CV 8.97%.

2nd Study : Oxford Pipettor vs Differential Pipettor, each using a new disposable tip each time.

	Run 3 Oxford Pipettor	Run 4 Differential Pipettor
Mean Volume	20.00 µL	20.35 µL
Absolute inaccuracy	0.00 µL	0.35 µL
Relative inaccuracy	0.02 %	1.75%
Standard deviation	0.196 µL	0.086 µL
CV% precision	0.98 %	0.42 %
Time	12:38 PM	12:51 PM
Temperature deg C	20.4 C	20.9 C
Total points run	14	14
Outside 2SD outliers discarded	1*	0
Points used in final calculation	13	14

*outlier was 19.27 µL, 2.5 SD low. Including it gave CV 1.37%.

Conclusions. I immediately saw that the precision I was getting with the Differential Pipettor was very good and the data shows that it was much better than the other two units and had no outliers. I assume this is because of some combination of better aspiration precision and better delivery. The point-and-push for dispensing gave clean and consistent looking contact-free sample delivery, which probably reduces user technique variability that goes with conventional pipettor touch-based dispensing for small volumes. The one direction, downward-only movement of the Differential pipettor also came readily to feel natural and it is fast and seems easy on the hand.

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