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SPECIAL REPORT

Tools to Support COVID-19 Patient Testing

Benefits of an Ergonomic and Electronic Pipette for RT-PCR

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Pipetting ergonomics has emerged as an important consideration in research laboratories, especially during the past year, in which diagnostic laboratory personnel have worked many long hours in response to the SARS-CoV-2 pandemic. Laboratory personnel who spend such time pipetting are susceptible to fatigue, which in turn can diminish testing accuracy (**1**). Daily pipetting for long periods also is associated with increased risk of repetitive strain disorders (**2**).

Using a mechanical pipette requires precise and relatively light action. Individually, piston control and tip ejection require 12.3–15.0 N and 14.3–28.0 N of force, respectively. But such actions can accumulate to a significant amount of physical strain in the course of a day. Conversely, an electronic, ergonomic pipette (1.3–3.0 N) is operated by the simple pushing of buttons, letting motors do most of the physical work. In a three-hour pipetting series, operations using an ergonomic and light mechanical Tacta pipette can tally 24.5 kN of force as compared with 35.5 kN using a heavy-to-operate mechanical pipette and 7.4 kN with a fully electronic Picus pipette. As Figure 1 shows, using an electronic Picus pipette requires 70–80% less total force for operation.

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This application note is a follow-up to our previous finding (3) and provides new data to show that pipetting with a fully electronic and ergonomic pipette yields HIGHLY REPRODUCIBLE results, even during extended use.

Results and Discussion

Herein we report the results of an experiment comparing dispensing accuracy using the light mechanical Tacta and electronic Picus pipettes. Our data cover the volume ranges used in routine reverse-transcription–polymerase chain reaction (RT-PCR) sample preparations (Figures 2 and 3). The benefit of ergonomics in pipetting accuracy is clear: Dispensing with ergonomic pipettes resulted in low standard deviations that did not increase with increasing pipetting time. By contrast, the standard deviations of the larger and heavier pipettes increased with prolonged use (Figure 2). We believe that this difference is because nonergonomic pipettes require more force to operate, which is difficult to sustain over a long period.

Next, we repeated the experiment to dispense 20 µL with pipettes that are relevant for an RT-PCR experiment: Tacta 2–20 µL and Picus Nxt 5–120 µL pipettes (Figure 3). We were surprised to find that the fully electronic pipette achieved the same low standard deviation as did the light mechanical Tacta pipette, which has a six times less nominal volume. It is important to note that pipettes are most accurate and precise when they are applied at their nominal or maximum volumes. The electronic pipette achieves accurate results because it removes the human-variance factor from piston control.

The Picus device standardizes pipetting across operators and speeds up repetitive tasks. It also

Figure 1: Pipetting workload comparisons from three hours of constant pipetting, covering the entire pipetting cycle (tip attachment, aspiration, dispensing, and tip ejection); Newtons (N) are used to quantify the amount of force required to perform the physical operations of pipetting. Reported numbers were determined by the technical team.

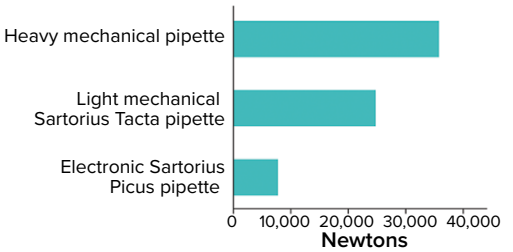
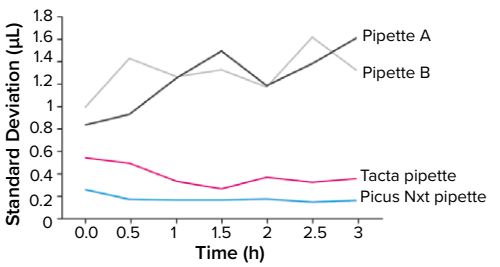


Figure 2: Standard deviation comparisons during a three-hour pipetting series when dispensing with a Picus Nxt electronic pipette, an ergonomic Tacta mechanical pipette, and two commercially available pipettes that are not optimized for ergonomics (pipettes A and B); all devices had a nominal volume of 1,000 µL and were used at 10% nominal volume (100 µL). Data for the Tacta, A, and B pipettes were published originally in (**3**). The Picus Nxt data were collected in 2021 and are presented for the first time here.



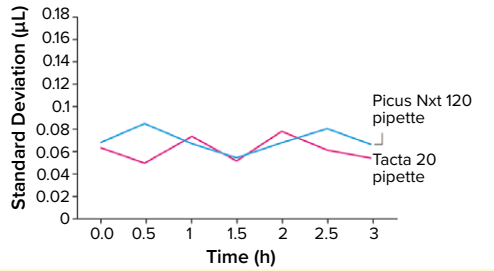
enables users to concentrate on pipetting angles and proper tip positioning in a target vessel. Increased confidence in performance also alleviates some of the stress induced by pipetting small volumes during RT-PCR sample preparation and other applications that demand similar precision.

A fully electronic pipette improves results by reducing variance and user fatigue during long periods of use. The Picus electronic pipette makes sample preparation comfortable by helping to achieve reliable results, alleviating accumulated strain on a user's hand, and speeding up work.

Materials and Methods

Pipetting performance during three hours of using mechanical or electronic pipettes was tested by calculating the standard deviation of the pipetting

Figure 3: Standard deviation comparisons of a Picus Nxt electronic pipette with an ergonomic mechanical pipette during a three-hour series of operations; the pipettes used to dispense 20 µL in forward pipetting were the Tacta single-channel 2–20 µL pipette and the Picus Nxt single-channel 5–120 µL electronic pipette.



In addition to standardizing pipetting across operators and speeding up repetitive tasks, the Picus device enables users to CONCENTRATE on pipetting angles and proper tip positioning in a target vessel.

results at 30-minute periods for each device. Each data point comprises at least 60 individual measurements. All pipettes were tested using their respective manufacturers' tips. All pipettes were serviced and calibrated according to their manufacturers' instructions before testing.

References

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Viral Transport Medium: Collecting and Transporting Clinical Specimens Containing Live Coronavirus (COVID-19 Virus)

Viral transport medium (VTM) is used for collection and transport of samples containing live viruses for detection by qPCR and other methods. VTM is a balanced salt solution (Dulbecco's phosphate buffered saline) enriched with peptides for virus stabilization, with a buffer solution to maintain the product at a neutral pH of 7.2 ± 0.2 at 2–25 °C. VTM contains phenol red as a pH indicator along with a high concentration of antibiotics and antimycotics to inhibit overgrowth of bacterial and fungal flora, maintain cellular integrity, and encourage virus preservation.

The medium is manufactured according to ISO 13485 QMS and complies with applicable current good manufacturing practice (CGMP) guidelines. It is ready to use (needs no further preparation), and it has been tested and validated for pH, osmolality, endotoxins, and sterility, as well as for coronavirus (COVID-19) preservation. The Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO) recommend collecting and transporting COVID-19 viral specimens in a medium that keeps them alive for up to 72 hours after collection at 2–25 °C. Collected samples should be processed within 72 hours.

Performance Comparison: COVID-19 inoculum was added in different concentrations to vials containing the Sartorius viral transport medium. The samples were stored at 2–8 °C for 24 hours, then inactivated with a lysis buffer. RNA was isolated from the sample and tested for the presence of COVID-19 viral particles by reverse-transcription polymerase chain reaction (RT-PCR) using the Allplex 2019-nCoV assay (Seegene, Inc.). A PCR test following VTM storage for 24 hours at 2–8 °C showed similar results to those of the PCR test when the sample was stored with Σ-Virocult medium for an hour at 2–8 °C. The PCR test both with and without phenol red showed similar results (data not shown).

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Table 1: Comparing the Sartorius viral transport medium performance with that of Σ-Virocult

	MWE Virocult (1h–4 °C)		Sartorius Viral Transport Medium (24h–4 °C)	
Sample	SARS-CoV-2 E gene (Ct)*	RNAseP Control (Ct)*	SARS-CoV-2 E gene (Ct)*	RNAseP Control (Ct)*
1	26.72	30.54	27.09	31.53
2	29.32	31.64	29.64	32.37
3	34.35	33.26	34.36	34.06
4**	NA	NA	NA	NA

* threshold cycle ** negative control