

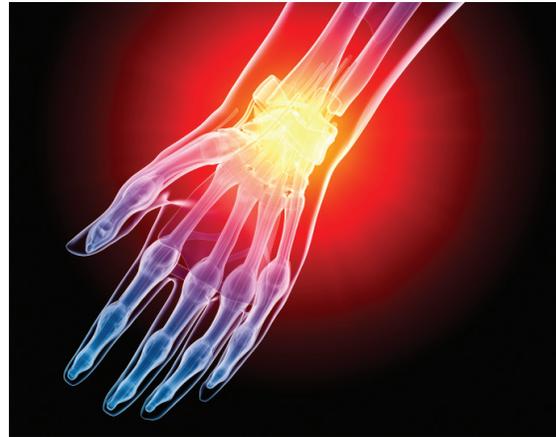
Superior Laboratory Ergonomics in the Biotix Universal Pipette Tip

Most Preferred by Laboratory Technicians

For Laboratory Technicians, the Risk is Real

Whether identified as Repetitive Stress Disorder (RSD), Repetitive Stress Injury (RSI) or Cumulative Trauma Disorders (CTD's), musculoskeletal injuries in the workplace have been a serious issue for the past decade, amounting to tens of billions of dollars in costs associated with diagnosis and treatment. In a recent news release summarizing 2009 statistics, the U.S. Department of Labor (DOL), Bureau of Labor Statistics (BLS) reported over 348,740 cases of ergonomically related injuries, which represented over 28% of all cases of workplace injuries and illnesses reported¹. Furthermore, over 40,000 cases were directly related to hand, wrist, finger and arm RSD's².

For laboratory technicians, the repetitive nature of standard laboratory techniques, especially pipetting, makes the risk of RSD quite real. In a study published by Bjorksten et al., manual pipetting for more than 300 hours per year increases the risk of hand and shoulder injuries³. When put in perspective, full-time laboratory technicians who pipette just three hours per day will far exceed the risk factor described in the study. Many RSD's among lab technicians can be traced to the choice of pipettor and the forces required for insertion and ejection of pipette tips⁴.



The High Cost of Repetitive Stress Disorders

Beyond the impact to physical well-being, RSDs can mean an average loss of 19 workdays from skilled employees and incurring worker's compensation costs⁵. Depending on the severity of the injury and potential surgical treatment, the financial impact can be upwards of \$100,000 per employee⁶. These costs are not insignificant to businesses and institutions, and can impact the bottom line. While there has been an increase in the establishment of workplace ergonomic programs, generally only very large and/ or well-funded organizations have been able to implement them. This is because the cost for implementing such programs can be quite steep. For example, the cost difference between a standard manual pipettor and an electronic pipettor specialized for ergonomics can be several hundreds of dollars. Addition-

ally, the specialized pipettors are generally only compatible with their own specially designed pipette tips sold at a premium. Replacing a large set of pipettors, paired with new specialized pipette tips, can exceed the budget of a typical research laboratory.

FlexFit™ Provides Ergonomic Solution

Through an innovative design approach and a focus on ergonomic solutions, Biotix has developed a new feature called FlexFit. This patent pending feature provides flexibility on the proximal end of pipette tips, reducing the necessary insertion and ejection forces between a pipettor and pipette tip. FlexFit has been incorporated into the Biotix branded line of universal fit pipette tips, and provides not only a better seal, but also improves ergonomics across a broad range of pipettors. In a comprehensive study performed by U.S. Ergonomics (Sea Cliff, NY), an independent testing laboratory, Biotix demonstrated superior ergonomic performance among all products tested. Study data revealed that Biotix tips had the lowest measured forces for application and ejection, had the lowest perceived effort by study participants, and was ranked highest by professional lab technicians as the most preferred pipette tip tested.

Ergonomic Study Design

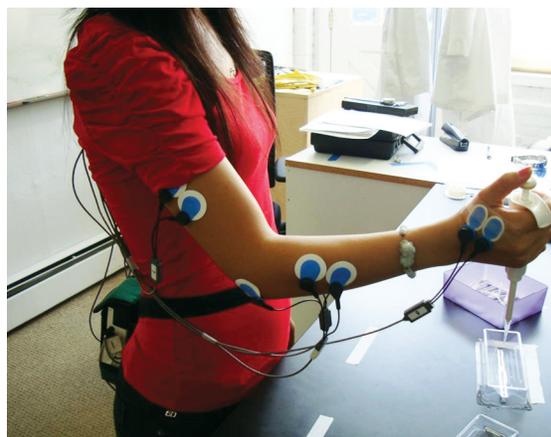
Controlled laboratory testing was conducted by certified professional ergonomists at U.S. Ergonomics. Based on the stringency of its testing standards, U.S. Ergonomics is one of the few independent testing laboratories in the United States to provide ergonomic product certification. In this study, eleven lab technicians (3 women, 8 men) who each had been using pipettors for over four years, for an average of

up to 3.3 hours per day, were recruited as test subjects. While wired to an electromyography (EMG), the test subjects ran through a number of pipetting tasks, including:

- Full Cycle Test – Test subjects completed a series of three full pipetting cycles (apply tip, aspirate, dispense, tip ejection)
- On/Off Test – Test subjects completed a series of 12 applications of the tip followed by tip ejection
- Step-by-step sequence of tip application, aspiration, dispense and tip ejection

Figure 1

Test subject wired to EMG for muscle activity monitoring



These tasks were completed with Biotix tips compared across each combination of pipettor and against competitive pipette tips shown on Figure 2. A total of two trials were collected for each test. Data from the EMG was collected and analyzed, along with a participant survey completed at the end of the study.

Figure 2

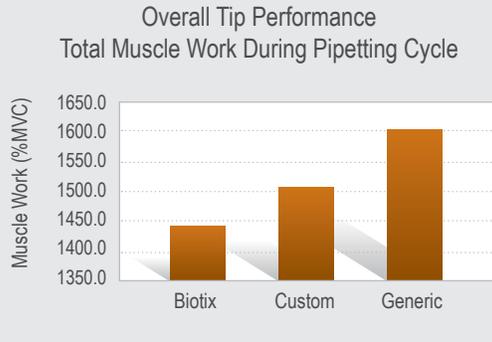
Brand	Volume
Biotix Pipette Tips	
Biotix	200µl
Biotix	1250µl
Custom Pipette Tips	
Brand E	20 - 300µl
Brand E	100 - 1000µl
Brand R	250µl
Brand R	1000µl
Brand T	300µl
Brand T	1000µl
Brand M	200µl
Brand M	1000µl
Brand S	1 - 330µl
Brand S	50 - 1250µl
Generic Pipette Tips	
Brand V	200µl
Brand V	1000µl
Pipettors	
Brand G	20 - 200µl
Brand G	100 - 1000µl
Brand E	20 - 200µl
Brand E	100 - 1000µl
Brand V	20 - 200µl
Brand V	100 - 1000µl
Brand T	20 - 200µl
Brand T	100 - 1000µl
Brand R	20 - 200µl
Brand R	100 - 1000µl

Study Results

The results of the study showed significant and measurable differences in force exertion, user perceptions and fatigue potential. Overall, the ergonomic performance of the Biotix tips based on the EMG measurements and the user perception was best among the tested products.

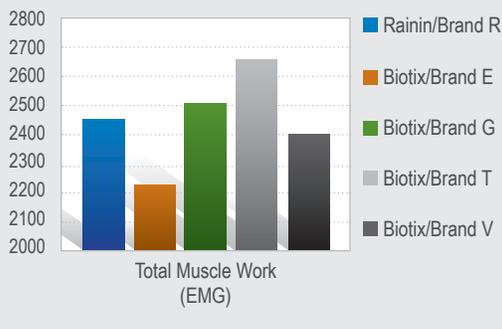
Measurements taken from the EMG recordings clearly demonstrate lower total muscle work overall during a standard pipetting cycle as compared to the custom and generic tip brands.

Figure 3



Note that Brand R data could not be included in the above data set because the Brand R pipettor is only compatible with the Brand R pipette tip – making it a specialty tip with no flexibility. Instead, the performance of Brand R’s custom system was compared to Biotix paired with the other pipettor brands. As shown in figure 4 below, the data highlights that Biotix can not only achieve equivalent performance to Brand R with multiple pipettor brands, it also underscores that end-users have more pipettor choices when using Biotix pipette tips.

Figure 4



While the data generated using the EMG revealed a clear difference in ergonomic per-

formance, the end-user perception of tip performance was also collected with a survey completed by the test subjects at the end of the physical testing. Adoption of ergonomic products and programs are only successful if the end-user has a positive experience with, or sees value in, adopting use of the product. Results from the survey showed the Biotix tips were ranked as the most preferred tip in categories including tip application effort, tip ejection effort, ease of aligning pipette on tip and overall comfort to use.

Figure 5

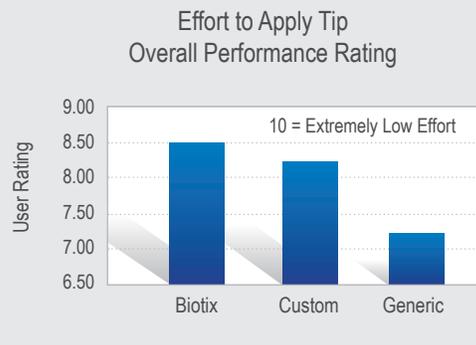


Figure 6

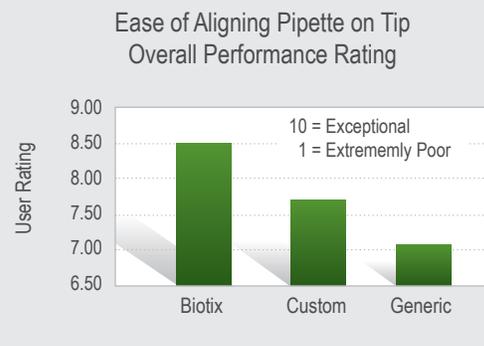


Figure 7

Effort to Eject the Tip
Overall Performance Rating

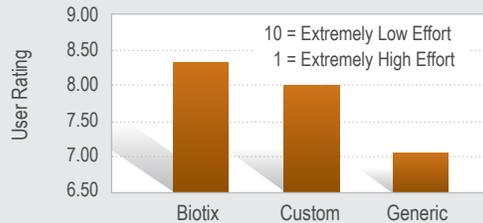
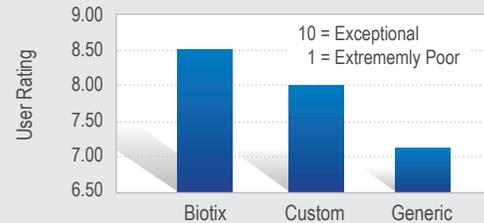


Figure 8

Overall Comfort During Use
Performance Rating



Summary

Ergonomic testing summarized in this technical bulletin indicated significant differences in the factors associated with measured insertion/ejection forces, fatigue potential and user perceptions. Overall, the ergonomic performance of the Biotix tips was the best among the products tested in this study, and was the most preferred among test subjects. Biotix pipette tips demonstrate ergonomic benefits across a broad range of pipettors, and provide end-users interested in adopting ergonomic programs a greater selection of pipettor choice.

Additional Information

Data appearing in this technical bulletin was extracted from the Biotix white paper, entitled “*Ergonomic Study of Biotix Pipette Tips*”. To receive a copy of this white paper, please contact Biotix Customer Service at csr@biotixinc.com

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