Senior Design / BS / MS Project
May - 2020

# Rapid Serological Pipette Opener

**Gaurav Gupta, JP Musi, Nimesh Nagururu, Sabah Ostaiza**
**Dr. Jorge Bohorquez, Dr. C.Y. Huang, Dr. Montero**

**Department of Biomedical Engineering**

## Abstract

Pipetting is an accurate, precise, and accessible technique for the handling and transfer of liquids among different containers. Currently, it is the standard liquid management system employed in research and medical fields. Serological pipettes, specifically, allow for transfer of liquids between 1 and 100 milliliters. In contrast to micropipettes, serological pipettes are packaged individually in plastic wraps or in plastic-paper wraps. When opening serological pipettes, it is necessary to use two hands to break the package seal. This requires putting down the pipette controller and must be done every time a new pipette is needed. The required two-hand operation, increases the time inside the Biological Safety Hood (BSH). The aim of this project is to develop a one-hand serological pipette opener device. The goal is a 30% reduction in the time taken to open serological pipettes. A concave blade magnet-secured mechanism was employed with 3D printed carbon-nylon components.

## Introduction

Serological pipettes are often used in high volume labs such as those involved in tissue culturing [1]. In order to prevent cross-contamination, a new sterile pipette must be used when dealing with different samples. Currently, pipettes are opened in the time- consuming process shown in Figure 1. All time is important in time-dependent assays such as the MTT metabolic test and Cell viability assay. Automated equipment to decrease time for pipetting are large and cost prohibitive [2]. Hence, we explored a low-cost device to help decrease the time taken to open pipettes.

**Figure 1.** Manufacturer Suggested Pipette Opening Technique

## Methods I Design I Analysis

Our master validation plan included two testing groups and three conditions shown below. Each group applied each specified testing condition thorough a timed course of liquid transfers using a pipette controller and pipettes of several sizes. *Note: all results for this testing protocol were simulated due to COVID-19.*

Testing Population
- Experienced (N=5, >1yr daily use)
- Inexperienced (N=5, <1yr to no exp.)

Testing Conditions
- Rapid Serological Pipette Opener
- Expedited Ripping
- Manufacture Suggested

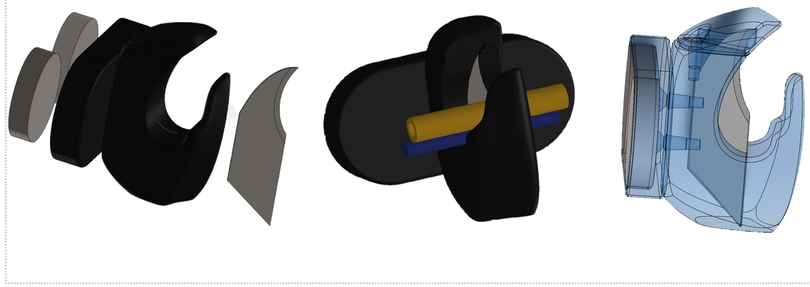

**Figure 2.** CAD models of our final prototype

## Results

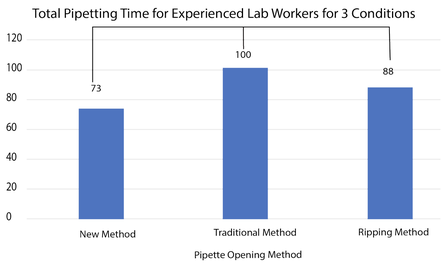


**Figure 3.** Average pipetting time for all experienced pipettors under the 3 pipette opening conditions

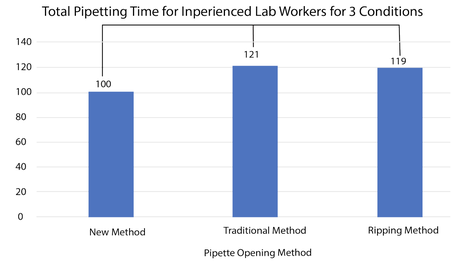


**Figure 4.** Average pipetting time for all inexperienced pipettors under the 3 pipette opening conditions

## Conclusion

Further Directions:
- General sterilization and durability testing will be performed.
- Risk assessment and safety testing will be performed with the current blade.
- Alternative mounting and securing mechanisms will be evaluated.

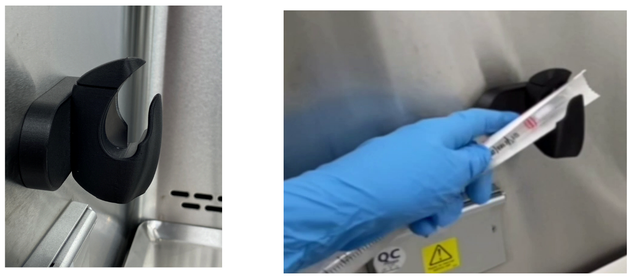

**Figure 5.** 3D Printed functional prototype mounted on a BSC

## Acknowledgments

We would like to sincerely thank the University of Miami Biomedical Engineering Department for helping this project come to fruition. Specifically, we would like to thank Dr. Ramón Montero, Dr. Jorge Bohorquez, Dr. Fabrice Manns, Dr. C.Y. Huang and Dr. Lukas Jaworski. Additionally, we would like to thank Anthony El Kommos for optimizing the prototypes design and 3D-printing procedure.

## References

[1] Sanders, E.R., Aseptic Laboratory Techniques: Volume Transfers with Serological Pipettes and Micropipettors. J Vis Exp., 2012(63).
[2] Wilson, D.J. and C.R. Mace, Reconfigurable Pipet for Customized, Cost-Effective Liquid Handling. Anal Chem, 2017. 89(17): p. 8656-8661.