



Eye Drop Assistant Device

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PROBLEM STATEMENT

The eye drop bottle is difficult to use for those with reduced dexterity, therefore, we propose an eye drop assistant solution that:

- Ensures the release of consistent dose of medication
- Allows for proper eye drop technique
- Improves ease of administration

MOTIVATION

- Ophthalmic diseases are most prevalent in the elderly population
 - Reduced dexterity, especially for this with arthritis
 - Most common treatment for delivery of medicated solution: eye drop bottles
- Difficulty use eye drops can result in:
 - Eye drop waste: 6.8-37.3% miss the eye with the drop [1]
 - Inconsistent treatment:
 - 25% of patients report missing doses because they run out of medication early [2]
 - Contamination from the bottle tip coming into contact with the eye [1]



Figure 1: Variety of Eye Drop Bottles Sizes [3]

BACKGROUND

Eye Drop Administration

- Drop Size
 - Current droppers release 21.5 μ l - 69.4 μ l
 - Suggested 5 μ l - 15 μ l
 - Effective, reduced drainage, lower cost [4]
- Proper Eye Drop Technique (Figure 2)
 - Eye drop should be placed in lower eyelid pocket[5]

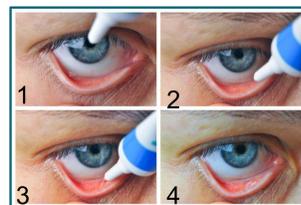


Figure 2: Proper Eye Drop Technique [6]

Competing Designs



Table 1: Comparison to Devices on the Market [7][8]

	MY DROPPER	Gentle Drop	Droppy
Prevents Contamination	✓	✓	✗
Provides Stability	✓	✓	✓
Reduces Eye Drop Waste	✓	✓	✗
Accommodates Dexterity Issues	✓	✗	✓
Allows for Proper Eye Drop Placement	✓	✗	✗

DESIGN CRITERIA

- The Device Must:**
 - Allow the eye drop bottle to be inserted into it for patient use
 - 1-2 cm radius and 4-10 cm height [9]
 - Accommodate dexterity issues
 - Force to less than 35 N for most extreme cases [10]
 - Allow for proper technique of eye drop administration
 - Minimize eye drop solution waste by ensuring only a single drop is dispensed
 - Budget of \$500

FINAL DESIGN

Features of Design

- Handles:**
 - Angled outward to create mechanical advantage
- Stability:**
 - Nose piece or platform
- Bottle Compression:**
 - Bottle neck support
 - Two sizes of device
- Convenience:**
 - Ability to replace cap and leave bottle in device

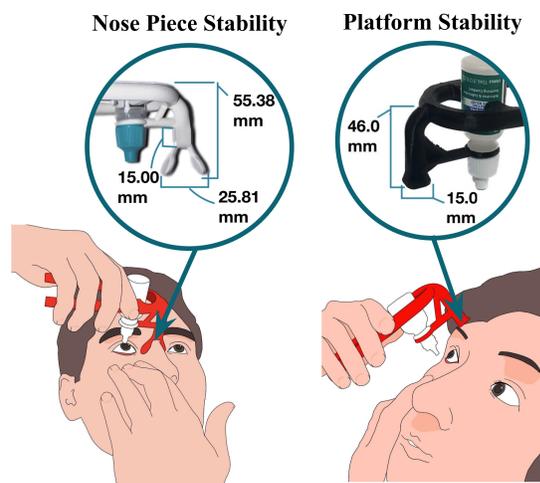


Figure 3: Demonstration of How to Use the Device

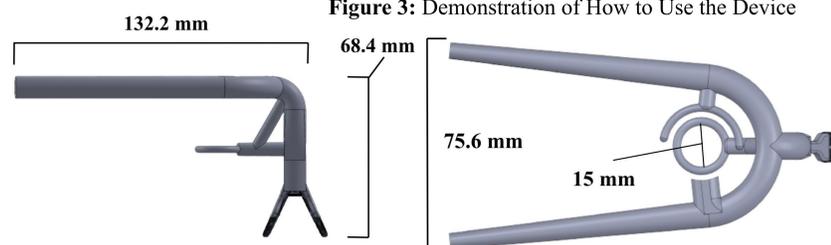


Figure 4: SolidWorks Rendering of Device for 2.5 mL Bottle

Packaging and Manufacturing

- Packaging:**
 - Clamshell Packaging
 - Cost Effective
 - Customizable
 - Easy to Open

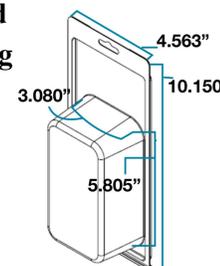


Figure 5: Packaging Dimensions

Benefits of Injection Molding:

- Cost Efficient
- High Quality Parts
- Large Volume Production
- Modular For Preference

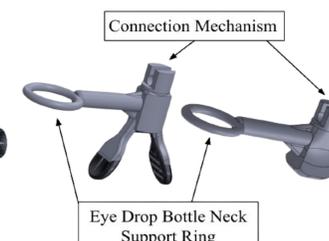


Figure 6: Injection Molded Stability Parts

TESTING & RESULTS

Single Drop Test

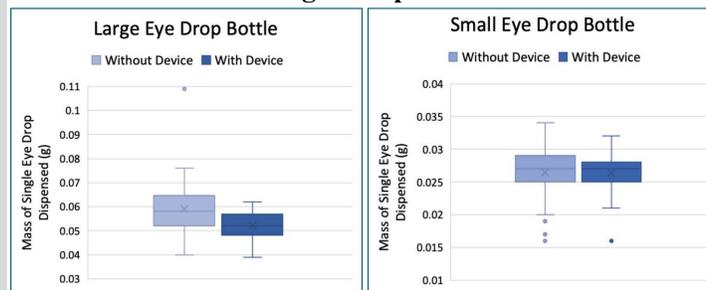


Figure 7: Box Plots Showing the Mass of a Single Drop Dispensed With and Without the Device

Squeeze Force Test



Table 2: Force Measurements for Small and Large Eye Drop Bottles

Small Bottle:	9.65 ± 0.133 N
Large Bottle:	37.904 ± 1.466 N

Figure 8: Compression Testing Set-up in the MTS machine

Preference Test

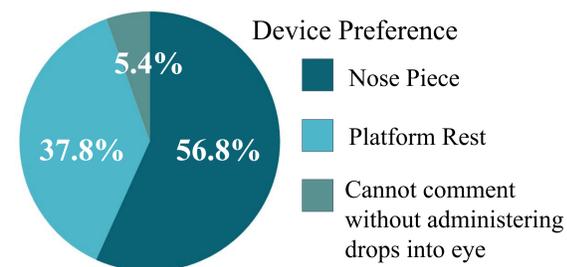
81% of users said they would use the device over using just using an eye drop bottle

Issues with Current Eye Drop Administration

Increased Ergonomics while Using the Device

Interest in Purchasing the Device

Suggestions Regarding Device Components



Device Preference

- Nose Piece
- Platform Rest
- Cannot comment without administering drops into eye

DISCUSSION

Design Achievements

- Delivers a more consistent drop size compared to the eye drop bottle alone, thereby reducing eye drop waste
- Handles create mechanical leverage to accommodate dexterity issues
- Offers stability options based on patient preference and anatomical differences

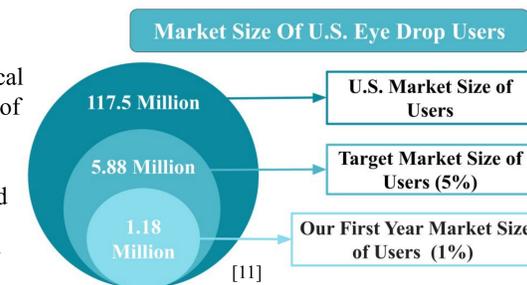
Design Drawbacks

- Limited to round eye drop bottles, not compatible with bottles of other shapes

BUSINESS MODEL

Target Market

- CEO of Harrow, an ophthalmic pharmaceutical company, suggested 5% of total eye drop users
- Patient First Eye Care
 - Elderly, Pediatrics, and Care Providers
 - Harrow and Speciality Pharmacies



Saving Calculations

- Total savings per year
 - \$4140

Cost Breakdown

- Clamshell Packaging & Labeling
 - \$0.61 + \$1.00
- IM units price decrease



FUTURE WORK

Next Steps

- Create a more universal design
- Partner with patient-first pharmaceutical companies
- More accurate cost of goods analysis
- Incorporate preference test feedback



Figure 9: Future Adjustable Design

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