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 using 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]

BACKGROUND

Eye Drop Administration

- Drop Size
- \circ Current droppers release 21.5 µl 69.4 µl
- \circ Suggested 5 µl 15 µl
- Effective, reduced drainage, lower cost [4]
- Proper Eye Drop Technique (Figure 2)
- . Tilt head back slightly and look up
- 2. Use one had to pull lower eyelid away from eye
- 3. Hold dropper directly over conjunctival sac
- 4. Squeeze bottle gently and allow drop to fall into pocket [5]

Competing Designs

- Droppy Eye Drop Dispenser
- Advantage: mechanical leverage
- Disadvantages: assembly required, eye drop administered into center of eye
- GentleDrop Eye Drop Guide
- Advantage: stability on bridge of nose
- Disadvantage: does not ensure one drop

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]
- Improve ease of use for people with reduced dexterity by lowering required squeezing force to less than 35 N to accommodate most extreme cases [10]
- Allow for proper technique of eye drop administration
- Minimize eye drop solution waste by ensuring that a single drop of eye drop solution is dispensed
- Budget of \$500









Eye Drop Assistant Device

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Eye Drop Guide [8]



Figure 8: Graphs showing two trials of the average drop size administered without the device vs with the device. Red: 15mL bottle. Blue: 2.5mL bottle.

— Yield strength: 1.110e+07

Figures 10 & 11: SolidWorks Generated Stress Distribution

Figure 12: Compression testing set-up in the MTS machine





DISCUSSION

Design Achievements

• Average drop size decreased with device by:

- 2.5 mL bottle: 7.2%, 15 mL bottle: 8.1%
- Force required to administer a drop decreased
- Measured force of small bottle device is within the desired range (0-35N) • Loading block not representative of full hand grip throughout the trial
- Eye drops are dispensed to a more consistent location • Device effectively decreased area of drop location by:
 - 2.5 mL bottle: **34.90%**, 15 mL bottle: **43.32%**
- Mechanical advantage was demonstrated following SolidWorks simulation

Design Drawbacks

• Bottle holder is positioned perpendicular to the nose bridge rest • User must tilt their head back until almost perpendicular to the floor • Fits round bottles but does not accommodate different shaped bottles

FUTURE WORK

- Consumer preference test at local retirement community
- To understand if the device makes the eye drop bottle easier to use
- Eye drops will be dispensed onto a surface, not into the user's eye
- Awaiting IRB exemption
- New IRB application to test the device's accuracy
- Test by having subjects try dispense eye drops into lower eyelid pocket ■ Results will show if the device is compatible with different anatomies • Need to accommodate consistent grip force location throughout MTS testing

- Reach out to WARF about possible patent opportunities
- Create a cost analysis and marketing plan
- Address packaging issues that may arise with the nose piece being attached • Pharmacy School "Shark Tank"

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