Novel Ophthalmic Minimal Dead Volume Drug Delivery System

Saving Money By Reducing Drug Waste

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Problem:
- Age related macular degeneration (AMD) is currently treated by injecting anti-VEGF or gene therapy (in clinical trials)
- Current injection techniques create cost burden due to dead volume and create variable flow rates → retinal tears, hemorrhaging, and cataracts (left to right)

Need: Develop a single-handed, in-office, drug delivery system with minimal dead volume and controlled flow rate

Solution:
Pressurized custom 3D printed chamber with compressed air actuates piston to initiate flow when start/stop mechanism is engaged

Components:
1. Pressure Chamber
2. Piston Chamber
3. Start/Stop Mechanism
4. Syringe
5. Dose Cradle

Verification Testing:
A dose [100 uL] drawn up, administered into weighing boat, then weighed. Average flow rate (uL/s) and dose accuracy (%) based on 100 uL was recorded.

<table>
<thead>
<tr>
<th>Requirement</th>
<th>P-Value</th>
<th>Pass/Fail?</th>
</tr>
</thead>
<tbody>
<tr>
<td>R2. Flow Rate</td>
<td>0.006</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>R3. Dose Accuracy</td>
<td>&lt;0.0001</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

Design Inputs:
C1. Dose ≤ 100 uL
R1. Dead volume ≤ 10uL
R2. Average flow rate = 10-20 uL/s
R3. Dose accuracy ± 15%

Future:
1. Make design shorter
2. Injection mold parts

Impact:
1. Saves user over $20,000 per injection
2. Total cost to build current device = $33.65!
3. Allows for a controlled flow rate

Revisions:
1. Make design shorter
2. Injection mold parts