CLeer: An At Home Ear Cleaning Device

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INTRODUCTION

According to Harvard Health Publications, earwax removal is the most common otolaryngologic procedure performed in American primary care settings. Although it is much safer and more effective to visit doctor’s office, expensive co-pay and inconvenience for both doctors and patients have been brought to our attention which led to the development of an at-home earwax removing device.

Though earwax is meant to aid in self-cleaning and providing protection against the infection, excess or impacted earwax can cause various symptoms including dizziness, pain, temporary hearing loss as well as perforated eardrums.

Thus, by combining the efficacy of sophisticated devices with convenience and usability, this novel design aims to provide a preventative method against earwax impaction caused by inappropriate practices or simply due to earwax overproduction.

CLINICAL NEED

A major problem to the at-home earwax removal is that there is a lack of safe and effective device that people can use. Though statistics suggest that a significant percentage of population is suffering from the impacted earwax, there are not many treatment options that meet all three criteria that patients often want: safety, effectiveness and easy usability.

Currently, there are several options available for at-home usage: curette, drops and irrigation. However, these options often result in some uncomfortable side effects such as infections, perforated eardrums or dizziness that people rely on more readily available and easy-to-use Q-tips for an alternative.

Because Q-tip is one of major causes for earwax impaction, there is a need for an alternative to Q-tips that can safely remove earwax while allowing the safety and convenience of at-home products.

MARKET DESCRIPTION

1. Market Survey

1. Frequency of Cleaning

- Percentage of people that consider Q-tips as a cleaning method
- 6% Never
- 11% No Q-tip
- 1% Q-tip
- 38% Daily
- 30% Weekly

- 2%-6% of the population at any time suffers form impacted earwax.
- In GP survey (2000) - when asked about the most challenging part of ear cleaning
  - 38% responded “complications while removing the earwax”
  - 29% responded “failure of earwax removal”

Potential target group includes:

1. Individuals with inappropriate earwax removing practices
2. Individuals with earwax overproduction, i.e. due to skin condition

2. Competitor – Most readily available products are compared and tested

<table>
<thead>
<tr>
<th>Product</th>
<th>Quantity</th>
<th>Cost</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>EarClear</td>
<td>1</td>
<td>$49.00</td>
<td>Syringe</td>
</tr>
<tr>
<td>WaxVac</td>
<td>2</td>
<td>$20.00</td>
<td>Vacuum – Battery Powered</td>
</tr>
<tr>
<td>Q-Tips</td>
<td>500</td>
<td>$6.48</td>
<td>Multi-use Disposable Hygiene</td>
</tr>
</tbody>
</table>

MECHANICAL ANALYSIS

1. Buckling-Displacement

- Maximum buckling load of the device: 21 kN at its widest diameter
- Force applied to the device: 2N:
  - Factor of safety: 10:1
  - Safe to use on a clinical level
- The weakest point for the buckling pressure is the edge with the narrowest diameter.

2. Displacement - Displacement

- Due to the flexibility of the material, stress and displacement are a non-issue.

3. Stress-Displacement

- Properties considered:
  - Price: Raw materials and processing
  - Young’s Modulus: Restricted to 1E10 psi for balance between stiffness and flexibility
  - Safety factor: Measured via buckling to ensure no failure under pressure
  - Materials chosen: Polypropylene (PP)
  - Due to compatibility, low price, high safety factor

3. Stress

Properties considered:

- Young’s Modulus: Restricted to 1E10 psi for balance between stiffness and flexibility
- Safety factor: Measured via buckling to ensure no failure under pressure
- Materials chosen: Polypropylene (PP)
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TESTING EVALUATION

Dry Earwax

<table>
<thead>
<tr>
<th>Before WaxVac</th>
<th>After WaxVac</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before</td>
<td>After</td>
</tr>
</tbody>
</table>

Wet Earwax

<table>
<thead>
<tr>
<th>Before Q-Tip</th>
<th>After Q-Tip</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before</td>
<td>After</td>
</tr>
</tbody>
</table>

PRODUCTION COST

<table>
<thead>
<tr>
<th>Volume</th>
<th>1651.3 mm³</th>
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</thead>
<tbody>
<tr>
<td>Injection Molded</td>
<td>10,000,000 parts</td>
</tr>
<tr>
<td>Material</td>
<td>$47,250 ($0.005 per part)</td>
</tr>
<tr>
<td>Production</td>
<td>$229,506 ($0.023 per part)</td>
</tr>
<tr>
<td>Tooling</td>
<td>$31,699 ($0.003 per part)</td>
</tr>
<tr>
<td>Total</td>
<td>$308,454 ($0.031 per part)</td>
</tr>
</tbody>
</table>

Acknowledgement

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