A New Approach to the Objective Assessment of HPD Performance in the Field

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  - Study of Subject-Fit Reinsertion
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  - Objective Assessment of HPD Performance in the Field: The Sonomax Solution
Part 2:
  - Study of Subject-Fit Reinsertion
Step 1

- Custom Earplug in minutes
- Comfortable (Soft Medical-Grade Silicone)
- Durable (3 years warranty)
Step 2

- Acoustic Seal Confirmed
- Individual Attenuation Measured (P-PAR)
- Adequate Protection is Ensured
- No Need to Derate
Step 3

- Filtered Earplug (according to TWA)
- Avoid Over-Protection
- Let Speech and Warnings Signals get through (EN458 Recommendation)
Step 4

- Comfortable Earplug Instantly Delivered
- Individual Attenuation Documented
- Implemented and Explained by Trained Personnel

Part 1:
- Objective Assessment of HPD Performance in the Field: The Sonomax Solution

Part 2:
- Study of Subject-Fit Reinsertion
Study Question

- [...] Furthermore, because the plug is tested immediately upon manufacture in the ear canal, while it is still coated with a lubricant that eases the fitting process, the seal obtained may be better than is actually experienced in day-to-day in practice. [...]  

Methodology

- Measure Attenuation (P-PAR) over Time in various Testing Conditions:
  - Post-Curing P-PAR vs Subject-Fit P-PAR
  - Fitting Noise, Explanations, Mirror, etc.
Methodology (cont.)

- Monitored Lubricant Use
  - Fitting Lubricant removed after Post-Curing Measurement
  - Subjects used personal water-based lubricant at their discretion

The “Learning-Curve” Hypothesis

- Hypothesis: naïve subjects will get better at inserting their earplugs over time... and practice.
4 Testing Conditions

- Silence
  - Manufacturer's written instructions only
- Fitting Noise
  - Pink Noise (AS1270)
- Explanations
  - “Pinna pull” Technique
- Mirror
5 Subjects Tested

<table>
<thead>
<tr>
<th>Subject #</th>
<th>Handedness</th>
<th>Occupation</th>
<th>Naive¹</th>
<th>Real Name</th>
<th>Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Right</td>
<td>Student</td>
<td>Yes</td>
<td>O.M.</td>
<td>Male</td>
</tr>
<tr>
<td>2</td>
<td>Left</td>
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<td>Yes</td>
<td>D.L.</td>
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<td>Y.S.</td>
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<td>4</td>
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<td>L.S.</td>
<td>Male</td>
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<tr>
<td>5</td>
<td>Right</td>
<td>Woodworker</td>
<td>No</td>
<td>J.B.</td>
<td>Male</td>
</tr>
</tbody>
</table>

¹ According to ANSI S12.6 (Method B, Paragraph 9.1.1)

Typical Individual Results

- Right and Left Ears...
Typical Individual Results:
Partial Conclusion

- Left and Right ears do not have necessarily the same $P-PAR$ (Post-Curing)
- “Learning-Curve” seems to related to Testing Conditions (Fitting Noise, Explanations, Mirror, etc.)
Group Results

- Use $PPAR(\text{Post-Curing}) - PPAR(\text{Subject-Fit})$ to normalize the results;
- This difference should decrease if the “Learning-Curve” Hypothesis is valid...
Subject's Comments

- ALL were disturbed by the Mirror;
- ALL were tired at the end of the test session;
- 2 reported pain in the ears following the multiple insertions (24 insertions per ear in less than 1 hour!).

Group Results: Partial Conclusion

- Silence:
  - Learning Curve is Evident
  - Fatigue after trial #4? (cf. Subject's Comments)
- Fitting Noise:
  - Consistent Improvement over Time
- Explanations:
  - Dramatic Improvement on Trial #1
  - Need for Re-enforced Explanations?
- Mirror:
  - Disturbing... (validate Subject's Comments)
Secondary Research Question:
Manual Dexterity vs. Fitting

- Study the impact of Dexterity (Left or Right Handed) to the quality of the earplug fitting.
Manual Dexterity vs. Fitting: Partial Conclusion

- Manual Dexterity slightly affects the quality of the subject-fits:
  - Recommendations: always use the weakest value (see Binaural Equivalent Attenuation Approach used in SonoPass™)
- The Measurement Device (SonoPass™) is so precise it can even tell your handedness!!!☺

Conclusion (1/3)

- The “Learning Curve” Hypothesis is Valid:
  - Naïve subjects will get slightly better protection over time;
  - Effect demonstrated is not biased by the fitting lubricant (that was not used).
- Sonomax approach is Safe and Reliable:
  - [...] the seal actually experienced in day-to-day in practice is equal or better than the one tested immediately upon manufacture [...]
Conclusion (2/3)

- Sonomax's Technology (SonoPass®) is a new practical approach for:
  - Objective Assessment of HPD Performance in the Field;
  - Studies on the HPD fitting and wearing habits;
  - Training and Motivation of the Workforces.
- Larger studies are presently conducted to validate those findings and to come with new ways to improve Hearing Protection...

Conclusion (3/3)

- One Solution - Individual Fit Testing
  - Arguably the best approach to assigning HPDs with the proper attenuation is to individually fit test each wearer. This is time-consuming, but well worth the effort. Not only does it provide the most accurate assessment for an individual user (presuming they wear the device in the same manner in actual use as they did during the test), but it affords an excellent opportunity to train and motivate the employee as well.

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