Upgrading Electric-Acoustic Stimulation External Technology: Speech Perception Outcomes

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Educational Objectives

• Describe the programming considerations of Electric-Acoustic Stimulation (EAS) recipients.
• List how programming of the acoustic component may influence speech perception with Electric-Acoustic Stimulation (EAS).
• Summarize speech perception outcomes across acoustic fitting methods for Electric-Acoustic Stimulation (EAS) recipients.

What is EAS?

• Electric-Acoustic Stimulation (EAS)
  » monaurally combines cochlear implant and hearing aid technologies for CI recipients with preserved low-to-mid frequency hearing in the implanted ear.
EAS Clinical Trial

• Inclusion Criteria:
  » Subjects with bilateral mild-to-moderate hearing loss in the low-to-mid frequencies, and severe-to-profound hearing loss in the high-frequencies

EAS Clinical Trial

• UNC Cohort:
  » Subjects implanted with the FlexEAS electrode
  » 33 of 34 subjects presented with preserved hearing postoperatively
  » Fit with the DUET speech processor
    » Ipsilateral combination of acoustic & electric technologies

EAS Clinical Trial

• Speech Perception:
  » Conditions: HA alone, CI alone, & EAS
  » Demonstrated significant improvements with EAS over either modality alone as early as 3 months
EAS Programming
• Though EAS recipients demonstrated a significant improvement in speech perception, it is of interest whether optimized programming methods would result in a further improvement in performance.

EAS Programming
• Programming Considerations:
  » Low-frequency filter assignment of electric stimulation
  » Fitting of the acoustic component
  » Crossover between the two modalities

• Aim: Explore potential influence of changes to the acoustic component on speech perception

EAS Programming
• Clinical Trial: fit acoustic component using the half-gain rule
• Compared acute performance when acoustic component was fit to NAL-NL1 targets

Dillon et al (2014)
Better
Æ
Better
EAS Programming

• When listening with the DUET, subjects demonstrated better performance when the acoustic component was fit with the NAL-NL1 method as opposed to the half-gain rule
• Recently, EAS subjects have been upgraded to the SonnetEAS device

<table>
<thead>
<tr>
<th>DUET</th>
<th>SonnetEAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trimpots to adjust gain, slope, volume &amp; knee point</td>
<td>6-channel acoustic fitting</td>
</tr>
<tr>
<td>Acoustic Range: 125-1800 Hz</td>
<td>Acoustic Range: up to 2000 Hz</td>
</tr>
<tr>
<td>Crossover Freq: 200-1100 Hz</td>
<td>Crossover Freq: 125-1700 Hz</td>
</tr>
</tbody>
</table>

Study Objective

• In the present report, we explored the influence of acoustic fitting methods when EAS recipients were upgraded from the DUET to the SonnetEAS external processor

Study Cohort

• 12 subjects, originally implanted as part of the EAS clinical trial
• Presented with residual hearing of ≤ 65 dB HL in the implanted ear
• All had ≥ 2 years of EAS listening experience
Programming Software

- Enter the audiogram measured on date of visit

Programming Software

- Adjustment of acoustic component

Methods

- Converted familiar DUET map for the SonnetEAS
  - Confirmed electric frequency filter assignments
- Three Acoustic Fitting Methods:
  - Manufacturer default settings
  - NAL-NL1 fitting method
  - NAL-NL2 fitting method
- Acoustic output for the NAL-NL1 and NAL-NL2 fitting methods were verified using real-ear or test-box measurements with individually-measured real-ear-to-coupler difference (RECD)
Methods

• Assessed acute speech perception when listening with each acoustic setting

• Order of fitting method was randomized across subjects

• Test Battery:
  » CNC words and phonemes
    - 60 dB SPL
  » AzBio sentences in a 10-talker babble
    - 10 dB SNR
    - 60 dB SPL

Results

• Subjects reported variable preferences in sound quality
  » Manufacturer (n = 0)
  » NAL-NL1 (n = 6)
  » NAL-NL2 (n = 6)

• Enrollment & subject evaluation is ongoing
Summary

• Acute speech perception assessment did not demonstrate a significant benefit in quiet or noise for an individual fitting method.

• Subjects demonstrated variability in scores between conditions and preference for sound quality.

• Subjects will continue to be followed after increased listening experience with the SonnetEAS processor to investigate whether duration of listening experience influences performance.
  » Other fitting variables are under investigation as well.

Considerations

• Enrollment and subject assessment is ongoing; therefore, results may change due to an increased sample size

• Duration of listening experience in one fitting method may influence performance

Considerations

• A caveat to the present data is not all subjects could be fit with the NAL-NL1 and/or NAL-NL2 prescriptive methods.
  » These subjects were not included in the present data analysis.
  » Optimal acoustic and electric fitting methods are currently being explored in CI recipients with hearing preservation in the surgical ear.

Further investigation may ultimately influence our clinical decision making regarding the optimal fitting of the acoustic component in these combined devices.
References


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THANK YOU

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