Long-Term Hearing Preservation in Electric-Acoustic Stimulation Patients up to 10 years

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ELECTRIC STIMULATION

- Mid and high frequency sounds picked up by the microphone of the audioprocessor
- Converted into code
- Code is sent to the coil
- Transmitted across the skin
- Implant interprets code
- Electrical pulses sent to the electrodes in the cochlea
- The auditory nerve relays signals to the brain

ACOUSTIC STIMULATION

- Low frequency sounds picked up by the microphone
- Digitally processed
- Amplification by the loudspeaker and relayed via ear mould to the ear canal
- Sounds reach the undamaged areas of the cochlea responsible for processing low-frequency sound
- The auditory nerve sends the signals to the brain
## Study Objectives

1. Develop a Hearing Preservation Classification System to **quantify residual hearing** after structure preservation surgery

2. Assess **long-term Hearing Preservation (HP) rates** in EAS recipients

3. Assess **long-term Speech Perception** (Quiet + Noise) in EAS recipients

4. Assess **long-term Subjective Benefit** in EAS recipients
## Methods

<table>
<thead>
<tr>
<th>Implanted Ear</th>
<th>CI experience at last LT</th>
<th>Implant</th>
<th>Electrode</th>
<th>Duration of Deafness</th>
<th>Age at implantation</th>
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</thead>
<tbody>
<tr>
<td>001</td>
<td>L</td>
<td>9y</td>
<td>Combi40+</td>
<td>Medium</td>
<td>68</td>
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<tr>
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<td>5y</td>
<td>Pulsar</td>
<td>Flex&lt;sup&gt;soft&lt;/sup&gt;</td>
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<td>CONCERTO</td>
<td>FLEX&lt;sup&gt;24&lt;/sup&gt;</td>
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<td>SonataTI</td>
<td>Flex&lt;sup&gt;24&lt;/sup&gt;</td>
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How can we quantify preserved Residual Hearing (RH)?
<table>
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<th>(Hz)</th>
<th>pre-op (dB HL)</th>
<th>post-op (dB HL)</th>
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<td>40</td>
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<tr>
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<tr>
<td>8k</td>
<td>120</td>
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**Frequency (Hz)**

**Hearing Threshold (dB HL)**

- 125 Hz: 20 dB HL pre-op, 40 dB HL post-op
- 250 Hz: 20 dB HL pre-op, 40 dB HL post-op
- 500 Hz: 35 dB HL pre-op, 40 dB HL post-op
- 1k Hz: 85 dB HL pre-op, 85 dB HL post-op
- 2k Hz: 100 dB HL pre-op, 110 dB HL post-op
- 4k Hz: 120 dB HL pre-op, 120 dB HL post-op
- 8k Hz: 120 dB HL pre-op, 120 dB HL post-op

**82.2% HP**

**Antwerp University Hospital**

University of Antwerp
Hearing Preservation, Calculation in [%]

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<tr>
<th>Hz</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>750</th>
<th>1k</th>
<th>1.5k</th>
<th>2k</th>
<th>3k</th>
<th>4k</th>
<th>6k</th>
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<td>20</td>
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<tr>
<td>AT Postop</td>
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<td>Max. testing level</td>
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<td>125</td>
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<td>125</td>
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\[
S = 1 - \frac{(PTA_{\text{Preop}} - PTA_{\text{Postop}}) \times 100}{\text{Max. testing level}}
\]

Legend:
- Green: Hearing preserved (postop) in [%]
- Orange: Hearing preserved (postop) in [%]

Classification for hearing loss:
- Dimensions: Severe (PTA > 70 dB)
- Classification: Preoperative (PTA)

It does not say if patient has functional hearing or not.

Classification is scaled to the preoperative audiogram.

Intended to classify Hearing Preservation after surgical intervention.

Qualitative classification (distinguishes subjects with good hearing vs. poor hearing).

The number gives you qualitative information on residual hearing.

Does not give an exact difference on how much volume is % of hearing you lost after surgery.
small continuous decline of HP rate of 3% per year

Implanted Ear
1. Ease of Communication

“I have to ask people to repeat themselves in one-on-one conversation in a quiet room”

2. Reverberation

“I have trouble understanding dialogue in a movie or at the theater”

3. Background Noise

“I have trouble understanding others when an air conditioner or fan is on”

4. Aversiveness

“The sound of screeching tires is uncomfortably loud”
Study Objectives

1. **HP classification system** offers a solution for the current lack of an accepted HP classification standard. Easy to use – to interpret based on conventional audiogram.

2. Small continuous decline in **HP rate of 3% per year**
   (Complete HP 27%; Partial HP 45%; Minimal 18%; Complete loss RH 9%)

3. **Continuous significant improvement** in the *speech perception* (Quiet + Noise)

4. Maximum **subjective reported benefit** achieved at **3M post-implantation**
   Subjective benefit **remains stable** during long-term follow-up