What Parents Should Know about Hearing Aids:

What’s Inside,
How They Work,
& What’s Best for Kids

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Goals

- Characterize the unique needs of children with hearing loss.
- Describe some of the advanced signal processing features of hearing aids.
- List the hearing aid features that are helpful to children with hearing loss.
Children with Hearing Loss are Unique

1. There aren’t as many of them.

![Pie chart showing 1 million children out of 30 million adults with hearing loss.](chart.png)
Children with Hearing Loss are Unique

2. Their hearing losses are different.

Pittman & Stelmachowicz (2003)
Children with Hearing Loss are Unique

3. Their needs are different.

   Adults use their residual hearing to *continue* to communicate,

   Children use their residual hearing to *learn* to communicate.
Styles

- In-the-canal
- In-the-ear
- Behind-the-ear
On The Outside

- Earmold
- On/off switch (maybe)
- Volume control (maybe)
- Battery compartment
On The Inside

- Microphone
- A/D converter
- Signal Processor
- D/A converter
- Receiver

Picture courtesy of Sonic Innovations
On The Inside

Acoustic  Electrical  Digital  Processor  Digital  Electrical  Acoustic
Signal Processing Technology

- Advanced signal processing solved a number of problems common to hearing aids
  - Improved fitting precision
  - Accommodate loud and soft sounds
  - Listening in different environments
  - Limiting acoustic feedback
  - Listening in noise
MAXX® 211 D

Compact BTE hearing instrument with switchable directional microphone, 6-channel digital
Wide Dynamic Range Compression (dWRDC), digital Noise Canceler (dNC) for comfort and ease
of listening in noisy environments, plus additional features for convenient and successful
operation.

<table>
<thead>
<tr>
<th>Key data</th>
<th>Ear Simulator</th>
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<tbody>
<tr>
<td>Max. gain</td>
<td>62 dB</td>
</tr>
<tr>
<td>Max. power output</td>
<td>130 dB SPL</td>
</tr>
<tr>
<td>Frequency range</td>
<td>&lt;100-4700 Hz</td>
</tr>
</tbody>
</table>

General features:
- Directional miniature electret dual microphone; directional or omnidirectional function can be set with switch.
- Compact, digital Phonak BTE
- Battery size 13
- Telecoil
- Automatic and manual volume adjustment
- Manual volume adjustment with programmable digital volume control (Range ±6 dB, ±10 dB or deactivated)
- O.T.-M. manual switch
- Audio input, MicroLink compatible
- Individual acoustic signals for start up, maximum/minimum volume and low battery warning

Accessories/Options:
- FM receiver: MicroLink MLx, MlxS or MLS
- Audio shoe ASS or ASS-MLx
- Ear hook HE2 1000
- Mini ear hooks HE2, HE2 1000
- Tamperproof system KS
- ecoscan
- Cover for volume control
- Choice of 11 ColorLine colors

Processing features:
- 6-channel digital Wide Dynamic Range Compression
- Feedback Manager
- MAXX noise suppression technologies:
  - 6-channel digital Noise Canceler (dNC)
  - Soft squelch

Software:
- PGG software version 8.3 or later

Hardware:
- Programmable with PC (IBM compatible), and Hi-PRO interface

Product information MAXX 211 D
Microphone Technology

- Omni-Directional Microphone
Microphone Technology

- Directional Microphone
Microphone Technology

- Advantages
  - Adjustable
  - Adaptive

- Disadvantages
  - Can be noisy
  - Requires sophisticated listener
  - Not all noise is always noise
Challenges for the Pediatric Audiologist

- Hearing aids are complex
- There are thousands of different hearing aids to choose from
- Children are not able to participate in the hearing aid fitting process
- Children’s needs change as they grow and mature
Hearing Aid Features for Children

- Durability
  - Wear and tear
  - Growth
- Auditory Access
  - Bandwidth
  - Gain
- Connectivity
  - Telephone
  - Classroom
  - Personal Audio Device
Questions?