Clinical Compression: Case Studies

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CAN YOU HEAR ME?

If you are having technical problems, please stay logged on and call Audiology Online at 1-800-753-2160
This session is available for 1.1 CEU

Must stay logged on for the full session

Must successfully complete a short quiz

Learning Objectives

After this course participants should be able to:

1. Formulate appropriate follow-up questions to patient reports.
2. Intuitively adjust compression characteristics based on patient reports.
3. Identify situations it could be beneficial to switch fitting formulas.
Compression

Education & Research

Application in a busy clinic across hearing aid manufacturers

What Must We Understand?

The purpose of compression
Relates to the patient’s listening needs

How compression is applied in hearing technology
Relates to the patient’s listening experience

When and how to adjust compression
Relates to achieving the patient’s desired sound quality
What Information Do We Need?

<table>
<thead>
<tr>
<th>Hearing Evaluation</th>
<th>Technology Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thresholds, WRS, MCL &amp; UCL</td>
<td>Bandwidth? How many channels &amp; bands have access to?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hearing Aid Style</th>
<th>Fitting Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Custom? RIC? BTE?</td>
<td>Proprietary or commercially available (e.g. NL2)?</td>
</tr>
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</table>

Fitting Formulas are important

- NAL-R
- NAL-NL1
- NAL-NL2
- DSL

VS.

Manufacturer Proprietary Fitting Formulas

Is any one better?
Every Patient is Different

Principles of Evidence-Based Statistic Analysis (e-STAT)

- Emphasizes audibility for speech understanding
- Developed for Starkey’s proprietary compression architecture
- Optimizes response modeling regardless of hearing aid style
- Minimizes vent-hearing aid interaction
JG7 Added the vent-hearing aid information to scripting in the case of questions
Jennifer Groeneveld, 3/1/18

JG8 Can we add some texture to the background of these slides?
Similar to the “quality” talk
Jennifer Groeneveld, 3/1/18
2009: e-STAT introduced as a combination of NAL-NL1 and NAL-R

- Low CRs
- Low CTs
- Fast-acting
- Based on the LTASS

Utilizes WDRC Principles

- Continues to be optimized for the best fitting starting point possible
- Based on clinical product research and professional input
### NAL-NL2
(Mild to moderate SNHL)

- Between 1.0 – 5.0
- Improves audibility of the softer components of speech
- Restores loudness perception
- May be beneficial for more mild hearing losses and new hearing aid wearers

### Compression Ratio

**Considerations**

**Lower CR**
- Between 1.0 – 5.0
- Improves audibility of the softer components of speech
- Restores loudness perception
- May be beneficial for more mild hearing losses and new hearing aid wearers

**High CR**
- 5.0 & above
- Utilized in compression limiting systems
- May be beneficial for wearers with recruitment
Compression Ratio (CR)

When adjusting CR’s be Mindful of:

- Higher CR (closer to 5 or above)
  - May adversely affect the clarity and pleasantness of the amplified sound
- Low CR (closer to 1)
  - May over amplify softer, non-important environmental sounds as well as moderate and louder inputs.

What Does a High vs. a Low KP Mean for the Patient’s Sound Quality?

**Higher TK**
- Linear more often
- “Louder fitting” may be beneficial for more severe hearing losses and previous hearing aid wearers

**Lower TK**
- In compression more often
- May be beneficial to users experiencing recruitment
NAL-NL2

Developed based empirical data collected over a decade regarding NAL-NL1

Why NL2?

Adults with mild to moderate hearing losses preferred less overall gain & higher CR’s that utilized in NAL-NL1

Let’s Jump into Inspire
Compression
Case Studies

Patient: Rachel Repeat
Rachel is a secretary who has been struggling to hear over the past few years. Reports include miscommunications at work and with her husband. Has never worn hearing aids.

<table>
<thead>
<tr>
<th></th>
<th>LEFT</th>
<th>RIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCL</td>
<td>80dB</td>
<td>80dB</td>
</tr>
<tr>
<td>UCL</td>
<td>115dB</td>
<td>115dB</td>
</tr>
<tr>
<td>WRS</td>
<td>88%</td>
<td>92%</td>
</tr>
</tbody>
</table>

Rachel will be fit with RIC hearing aids with closed domes bilaterally.
2 Weeks Later: First Follow-Up

“I’m not hearing as well as I was hoping to—speech just isn’t clear.”

What questions do you ask?

Follow-Up Questions For the Patient

- How often are you wearing them?
- No one is clear or just certain people?
- What specific situations having difficulty in?

Questions Regarding the Device & Settings

- What experience level is set?
- What fitting formula is set?
- Was this fitting verified?
- Any adjustments made at first fitting?
## Device Settings: Answers

<table>
<thead>
<tr>
<th>In the Software</th>
<th>Other Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Experience level 1</td>
<td>The data log</td>
</tr>
<tr>
<td>• NL2</td>
<td></td>
</tr>
<tr>
<td>• Fit was verified</td>
<td></td>
</tr>
<tr>
<td>• No other adjustments made at first fitting</td>
<td></td>
</tr>
</tbody>
</table>

## Rachel’s Answers

<table>
<thead>
<tr>
<th>First Follow-Up</th>
<th>Data Log Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>“I wear them when I can but I have been taking them out at work since they aren’t helping.”</td>
<td>Wearing 3 hours a day (avg.)</td>
</tr>
<tr>
<td>“No one is clear, really.”</td>
<td></td>
</tr>
<tr>
<td>“All the time, especially at work where I need the most help.”</td>
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</table>
What Do We Do?

What is a simple adjustment before considering others?
Increase the experience level

What Else?
Counsel to wear more often

Solution
1. Move to Experience Level 3 (at target)
2. Counsel on consistent use
3. Decide no other adjustments at this time

4 Weeks Later: Second Follow-Up

“It’s better than before but still not great. I’m still missing things, especially in noise.”

What do you do next?
Our Thoughts

Noise Control Options?

*Hearing speech in noise issue:*
  - General noise control
  - Speech-In-Noise Control
    - Increase
  - Directionality – dedicated directional program or adaptive features
  - Expansion
  - Other special features

Our Thoughts

Frequency-Response or Compression Changes?

*Speech clarity issue:*
  - Fine tuning:
    - Increase overall mid to high frequency gain
    - Decrease CRs
    - Raise MPO
    - Decrease expansion

*Hearing in noise issue:*
  - Fine tuning:
    - Decrease soft level, low frequency gain
Improving Speech Clarity

Why Decrease CRs?

Think:
Compression although beneficial, is a form of distortion
- Too high of a CR may be too much for some listeners

Solution
Decrease CRs
To help restore normal perception of loudness and speech clearly

Why Raise MPO?

Think:
MPO is the maximum output of the HA; once this point is exceeded HA goes into saturation
- Too low of MPO can cause HA to go into saturation too often; potentially for louder speech

Solution
Raise the MPO
Allows the user to experience the full range of loudness
Improving Speech Clarity

**Why Decrease Expansion?**

Think:
Purpose of expansion ensures the weakest sounds in environment are not over amplified, ideally without sacrificing soft speech

- When expansion is *too aggressive* it can negatively impact speech

**Solution**

Decrease Expansion
Not reducing gain for soft level speech

You have successfully fit Rachel!
Patient: Daniel Distant

First-time hearing aid user. A month ago you fit him with custom CICs bilaterally. During his follow-up he reports: “I’m hearing sounds and voices farther away better than the person speaking right in front of me.”

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<td>115dB</td>
</tr>
<tr>
<td>WRS</td>
<td>78%</td>
<td>72%</td>
</tr>
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</table>

More on Device Settings

In the Software

• Experience level 3
• e-STAT
• Data log shows wearing 14 hours a day (avg.)
What Follow-Up Questions Do We Have for the Patient?

- Where exactly is this happening?
- All the time? Sometimes?
- Only in noise?
- Are you hearing a person behind or next to you better or actually across the room?

Our Thoughts

**Directionality?**

- Adaptive directional features
- Dedicated directional program
Our Thoughts

Frequency-Response Changes?

Why?

Fine-tuning:

- Increase mid to high frequency gain for loud inputs
- Decrease soft gain
- Increase your overall gain

Why?

- Distant speech can be mistaken for soft speech that needs to be amplified
- Close speech can be confused as loud sound that needs to be compressed

Solution

Increase loud, decrease soft

- Mid to high frequency loud gain

Our Thoughts

Compression Changes?

Why?

Compression Changes:

- Reduce CR in between moderate & loud
- Reduce CR between soft & moderate

Why?

- Lower compression ratios help maintain a normal loudness perception
- Lower compression ratios will provide more gain to moderate & loud level sound relative to soft level sound

Solution

Reduce CRs overall
Lowering CRs

**Pros**
- Improve audibility of softer sounds/soft speech
- Easier for a new user to acclimate to – more pleasant sound

**Cons**
- May overamplify weak sounds
- May overamplify moderate and loud sound

Solution

**Daniel’s Answer**
“It’s not that I am hearing someone directly behind me it’s more that I hear conversation is going on across the room better than I can hear what the person directly in front of me is saying.”

**Corresponding Adjustment**
Fine tuning/gain changes
You have successfully fit Daniel!

Patient: Max Power, 60

Long-time hearing aid user — wearing the same pair of aids for over 15 years. Recently decided to upgrade technology.

We will fit him with Power BTEs with custom molds bilaterally.
2 Weeks Later: First Follow-Up

The new devices are in the bag and he has his old hearing aids on instead.

“I have been trying to wear these new hearing aids everyday but I just don’t hear as well as I do with the old ones.”

**What questions do we ask?**

<table>
<thead>
<tr>
<th>Follow-Up Questions For the Patient</th>
<th>Information to Gather from the Software</th>
</tr>
</thead>
<tbody>
<tr>
<td>• How often are you wearing the new hearing aids?</td>
<td>• Data log?</td>
</tr>
<tr>
<td>• What specifically are you not hearing as well?</td>
<td>• What fitting formula is set?</td>
</tr>
<tr>
<td>• What specific situations having difficulty in?</td>
<td></td>
</tr>
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</table>
Max’s Answer

“I just do not feel like these hearing aids are working as well, like they are not fully on. I hear better with them on than nothing at all but I am not hearing as much sounds as I did with my old ones.”

Data Log Info

Wearing 8 hours a day (avg.)

Considerations Based on Case History and Patient Reports

• Long time hearing aid user
• What features effect how HA sounds that the Max is not used to?
### What Can We Do?

<table>
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<tr>
<th>Change the Fitting Formula?</th>
<th>Why NAL-R?</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAL-R</td>
<td>NAL-R is a linear fitting formula and this person is used to a linear sound</td>
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</table>

### What other options do we have?

- Reduce expansion
- Reduce noise controls
- Other special features?

<table>
<thead>
<tr>
<th>Why would this help?</th>
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<tbody>
<tr>
<td>May want to hear as much sound as possible that expansion and other noise controls limit.</td>
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</table>
You have successfully fit Max!

Questions?
Thank you

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