FREQUENCY LOWERING TECHNOLOGY: CONSIDERATIONS FOR MAXIMIZING EFFECTIVE FITTINGS

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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

DON'T LET HIGH FREQUENCY HEARING LOSS CAUSE PATIENTS TO MISS OUT ON THE VOICES THEY NEED TO HEAR OR THE ONES THEY WANT TO HEAR.
SOME THINGS ARE TOO IMPORTANT TO MISS...

Spectral iQ

Let Spectral iQ help bring them into focus

- Speech Perception
- High Frequency Information
- Rationale for Frequency Lowering Technology
- Approaches to Frequency Lowering
- Fitting Considerations
- Verification
- Counseling
- Fitting & Follow-Up
- Acclimatization
- Take Home
- Resources
SPEECH PERCEPTION

The Ear Hears

The Brain Interprets

COMPONENTS OF SPEECH

- Frequency
- Dipthongs
- Harmonics
- Intensity
- Formants
- Phase
- Vowels
- Plosives
- Liquids
- Nasals
- Affricates
- Fricatives
- Glides
- Timing

The changing spectral envelope created by any number of sound combinations is what our brains use to interpret a spoken message.

HIGH FREQUENCY INFORMATION
Children need access to speech above 4K Hz. S & Z

Over 20 linguistic uses for /s/ and /z/.

TH & CH 50%
Fricatives and affricates account for about 50% of English consonants.

> 3K Hz 25%
Frequencies above 3,000 Hz contribute approximately 25 percent of the audible speech cues required for recognition of spoken language.

High frequency cues in the 3500-9000 Hz region are either important or do not create a disadvantage for many hearing aid fittings.

RATIONAL FOR FREQUENCY LOWERING

RATIONALE

Benefits

Recognition Of Sentences In Quiet And Noise

Localization

Speech Clarity

Spatial Unmasking

Recognition Of Fricatives

Ease Of Listening

Music Quality

Novel Word Learning
HEARING AID BANDWIDTH

BANDWIDTH CONSIDERATIONS
- Proprietary Default Strategies
- Slim Tube Fittings

FEEDBACK
Pure Wave Feedback Eliminator
Maximum gain without feedback!

COCHLEAR DEAD REGIONS
A region of the basilar membrane where the inner hair cells and/or neurons are no longer functioning.

Moore, Glasberg and Vickers (1996)
APPROACHES TO FREQUENCY LOWERING

LANDSCAPE

Linear Frequency Transposition
Non-Linear Frequency Compression
Frequency Translation

Cochlea
Linear Frequency Transposition
Cochlea with Hearing Loss & Hearing Aid
Bandwidth

Cochlea
Non-Linear Frequency Compression
Cochlea with Hearing Loss & Hearing Aid
Bandwidth
Fitting Considerations

- High frequency hearing loss
- Little-to-no improvement in word recognition abilities with traditional approaches to high frequency amplification
- Increased distortion or sensitivity with appropriate high frequency gain
- Reduced high frequency audibility as a function of the prescriptive formula, fine tuning or acoustic coupling

Clinical Presentation

Fit The Difference!

www.spectraliq.com
Smart Candidacy

Slope ≥ 25 dB per octave

55 dB HL or better

ALL

55 dB HL or worse

ANY

55 dB HL or worse

ALL

55 dB HL or worse
SMART CANDIDACY CRITERIA

- All thresholds below 1000 Hz are 55 dB or better
- Slope is > 25 dB per octave between 250 – 4000 Hz
- Any threshold between 1000 – 3000 Hz is 55 dB or worse
- All thresholds between 4000 – 8000 Hz are 55 dB or worse

DEFAULT LOGIC

<table>
<thead>
<tr>
<th></th>
<th>Default On</th>
<th>Default Off</th>
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</thead>
<tbody>
<tr>
<td><strong>Binaural Fit</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neither ear meets criteria</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Both ears meet criteria</td>
<td></td>
<td>✔️</td>
</tr>
<tr>
<td>One ear meets criteria and the opposite ear thresholds are within 10 dB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>One ear meets criteria and the opposite ear are &gt;10 dB different</td>
<td></td>
<td>✔️</td>
</tr>
<tr>
<td><strong>Monaural Fit</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Audigram meets the criteria</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td><strong>Pediatric Patients</strong></td>
<td>✔️</td>
<td>✔️</td>
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</table>

PROFESSIONAL CONTROLS

- Spectral iQ On/Off
- Spectral iQ Bandwidth
- Spectral iQ Gain

ENABLING BY MEMORY

- Spectral iQ On/Off
- Spectral iQ Gain
**MANUAL ENGAGEMENT**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Spectral iQ Gain</td>
<td>3 for all hearing losses</td>
</tr>
<tr>
<td>Spectral iQ Bandwidth</td>
<td>3 to 5</td>
</tr>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>4K to 8K are &gt; 70 dB</td>
</tr>
<tr>
<td></td>
<td>4K to 8K are 55 dB to 65dB</td>
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</table>

**VERIFICATION**

**REAL EAR MEASUREMENTS (REMS)**

- **Match Target**
- **Verify Activity**
  - Spectral iQ OFF
  - Spectral iQ ON

**Verifit® Live Voice Verification**

Obtain real ear curve while voicing /s/ 
Spectral iQ OFF > ON > compare
6300 Hz Signal

Verifit®
Calibrated signal Verification
6300 Hz

Spectral iQ
> OFF
> ON
> compare

Real Ear Measurements - Feature ON

SPEECH MAPPING

Spectral IQ OFF vs. ON

Spectral iQ Off:
Spectral iQ On:

BEHAVIORAL VERIFICATION
PLURALITY WORD TEST

- OFF vs. ON
- Mask lip-reading cues
- Engage family members

INTERPRETATION

- Achieve > 50% correct:
  Settings are appropriate
- Achieve < 50% correct:
  Increase Spectral iQ Gain in 1 dB steps and then adjust Spectral iQ Bandwidth.

WIN-WIN-WIN!

- Helps establish best bandwidth and gain settings
- Professional verification of benefit
- Patient confirmation that feature is helpful

ADDITIONAL OUTCOME MEASURES

- Ling-6 Sounds (Scollie et al., 2012).
- UWO Plurals Test (Glista and Scollie, 2012).
COUNSELING

Your hearing loss has diminished your ability to hear the important consonant sounds of speech. That’s why you have a difficult time hearing and understanding others. In addition, the damage to your inner ear has created a situation where louder doesn’t always mean clearer. Spectral IQ is a feature designed to increase the audibility of important high frequency speech sounds in order to improve your overall ability to understand speech.

COUNSELING

• Some patients will report altered sound quality with the feature engaged.
• The goal at the time of fitting is to focus on the value of the feature and tolerance for it.
• Use the behavioral verification tool to verify improved speech perception.
• Fine tuning for sound quality should occur at the follow-up visit!

SOUND QUALITY

SPECTRAL IQ STUDIES

20 subjects

S Test

D-prime

wind 65 dB SPL

noise 45 dB SPL

Robinson, Baer & Moore, 2007
SPECTRAL IQ STUDIES

20 subjects

3 conditions
Off | On | Maximum

Symmetrical, mild, steeply sloping to severe or gradual, sensorineural hearing loss

20 subjects

Spectral iQ Off Settings Chosen by Subject
Spectral iQ Max Setting

%
ACCLIMATIZATION

…a listener’s reaction to a new processor at the time of fitting may change after they wear it for a few weeks. If I fine tune only in response to their initial reaction, I might tune away any possibility that they would get the benefit in time. Obviously, the initial fitting needs to be physically and acoustically comfortable, but can also offer some new audibility that the wearer agrees to take home.

Susan Scollie

COUNSELING

Yes, Mr. Jones, the sound quality is different than what you’re used to (or what you think you might like), but the test outcomes show us that using this feature helps you understand your daughter better.

I’d like you to try it for the first two weeks, and we’ll evaluate sound quality again when you come back.

FITTING & FOLLOW UP

• Behavioral verification procedure
• Counseling

FIRST FIT

Do NOT turn Spectral IQ OFF if sound quality issues are reported. Focus on benefit, comfort and tolerance!
FOLLOW UP VISIT

- Sunshine
- Seashell
- Seashore

“Smart Sally sold seven sets of Starkeys to some very savvy scientists.”

ASYMMETRICAL HEARING LOSS

- Spectral IQ defaults OFF in the presence of asymmetry >10 dB
- Consistent signal processing in a binaural fit
- Ear specific adjustments

STEEPLY SLOPING HFHL

TRY IT!

“I'M NOT HEARING PLURALS VERY WELL.”

Increase Spectral IQ Gain

Increase Spectral IQ Bandwidth
“SOUNDS ARE TOO LISPY.”
Decrease Spectral iQ Gain
Stronger
Weaker

“EMBARRASSING.”
Decrease Spectral iQ Bandwidth
Maximum
Minimum

“MY VOICE HAS AN ECHO.”
Decrease Spectral iQ Gain
Stronger
Weaker

“OTHER VOICES ECHO WHEN OTHERS TALK.”
Decrease Spectral iQ Bandwidth
Maximum
Minimum
Decrease Spectral iQ Gain
Stronger
Weaker
“MY HEARING AIDS CHIRP.”

- Run PureWave Feedback Eliminator
- Turn Spectral iQ OFF
- Turn Spectral iQ back ON
- Custom tip for RIC!

EXPERT ASSISTANT

ACCLIMATIZATION

ACCLIMATIZATION

Improvement in recognition scores over time
Improvements in rated sound quality
Decreased listening effort
HEAR COACH

- Increase Hearing Instrument Benefit
- Increase Patient Delight and Satisfaction
- Lower the Perceived Hearing Handicap
- Reduce Return Rates

READ MY QUIPS

TAKE HOME
Replicates high frequency sounds
Restores audibility in Real Time
Broad Bandwidth
Less distortion
Smart Candidacy and Best Fit Logic

Too Important To Miss!
THANK YOU

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