AURICAL: FITTING TOOLS AND TIPS TO KEEP YOU ON TARGET

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Snapshot of Today’s Training

AGENDA
1. Current Fitting Practices
2. Aurical PMM/HIT Overview
3. Workflow Efficiency with Aurical
4. RECD and Coupler Based Fitting
5. Advanced Feature Verification

Hands-On Demonstration of Aurical HIT

CURRENT FITTING PRACTICES

FROM A PEDIATRIC PERSPECTIVE

CHILD
- Hearing loss configuration can be more varied, progressive or asymmetric due to higher incidence of comorbid pathology and medical conditions
- Still learning and developing language so need to ensure that speech is maximized
- May listen to speech from children and female speakers more frequently versus adult males so need to ensure audibility for these speakers

ADULT
- Presbycusis higher incidence of loss causes symmetric hearing loss pattern
- Acquired language and can “fill in gaps” through previous learning
- Exposed to more adult speakers on a daily basis so may not encounter listening to speech from young children or as many female speakers on a daily basis

“American Academy of Audiology Clinical Practice Guidelines: Pediatric Amplification” June 2013
AAA 2013 Pediatric Amplification Guidelines

**PURPOSE OF AMPLIFICATION**

- Provide amplification for the hearing-impaired child that allows them the opportunity to access as much as feasible of the auditory environments, especially speech.
- By achieving this, the child is given the opportunity to develop age-appropriate receptive and expressive oral communication, language development, literacy skills and psychosocial skills.

**PRIMARY GOAL:**

- Provide audibility as possible across LTASS while ensuring intensity is comfortable and non-damaging.

**SECONDARY GOALS**

- Minimal distortion
- Appropriate signal-processing strategies
- Use of features that maximize the desired signal’s audibility
- Reduce noise/unwanted sounds
- Physical comfort to ensure daily use
- Ease of connectivity to external devices

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**AAA Pediatric Amplification Guideline (2013)**

**OUR FOCUS TODAY**

- Assessment, candidacy, support
- Device selection, earmold selection, prescription
- Verification and fine tuning (probe mic) with speech & for each feature
- Validation (outcome measurement) for every child

To ensure that needs are met After new features

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**Principles Underlying Effective Amplification for Children**

*Based on child's individualized needs and abilities, diagnostic information, listening environments, and clinician experience the goal is to select the technology and features of amplification for the child's success and must be reevaluated as needed.*

**Decision Process:**

- 1) Routing of the Signal (AC/BC/Electrical; Monaural/Binaural/Bi-Modal)
- 2) Hearing Aid Style
- 3) Adequacy of the Earmold
- 4) Safety Considerations (Batteries, Activity, Medical)

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*“American Academy of Audiology Clinical Practice Guidelines: Pediatric Amplification” June 2013*
Signal Processing and Features of Amplification for Children

**Fundamental Requirements for Amplification Signal Processing**

1) Minimal distortion
2) Sufficient frequency shaping to meet prescriptive targets of the child’s hearing loss
3) Appropriate compression for flexibility to restore low level input audibility while ensure comfort for high level inputs
4) Appropriate maximum output limiting to reduce exposure to loud sounds with minimal distortion

*How do we ensure these Fundamental Principles and Requirements are being upheld?*

"American Academy of Audiology Clinical Practice Guidelines: Pediatric Amplification" June 2013

Recommendations for Fitting/Verification of Amplification in Children

1) Use of Prescriptive Targets from well documented research (DSL/NAL)
2) Verification of audibility via Real Ear (PMM) / RECD measurements with use of speech-signal
3) Special attention to verification of high frequency audibility
4) Verification of advanced amplification features
   - Directional microphones
   - Noise reduction
   - Frequency lowering
   - Feedback suppression

"American Academy of Audiology Clinical Practice Guidelines: Pediatric Amplification" June 2013

**Prescriptive Fitting – The Basics**

- Defines the gain recommended across the frequency spectrum, based on hearing levels and other considerations.
- Independent research-based options:
  - DSL v5.0; NAL-NL2
  - Use recorded speech-like signals (Rainbow Passage, ISTS) as stimulus of choice
  - Both of which are evidence based with a host of literature validating them as tools for best practice
  - Differing targets for soft, average and loud input and MPO
  - Allows for a consistent fitting approach regardless of make, model or manufacturer of hearing device

**Fitting Formulae Review**

- NAL = National Acoustic Laboratories
- NL = Non-Linear
- Threshold-based algorithm that aims to maximize speech intelligibility at any level while keeping the overall loudness of speech at or below normal overall loudness
- Has considerations for gender, age, and level of experience
- Typically used with adults

- DSL = Desired Sensation Level
- Aims to normalize loudness at each frequency
- Loudness equalization aims to equalize the perception of loudness over a range of frequencies
- Adults versus Children
  - DSL targets are generally about 7 dB lower for adults than for children
  - There are different targets for quiet versus noise
  - DSL for adults will have more high frequency gain
What are the Verification Tools Available in PMM?

<table>
<thead>
<tr>
<th>Probe Mic Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prescriptive Target Based Fitting</td>
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What are PMM “Basics” vs “Advanced”?

- This is a very subjective idea
- ~50% of Audiologists are performing some sort of Real Ear measures

**Basic**
- Knowledge of the hardware, control panel and data screen
- Probe tube calibration and placement
- Speaker calibration
- OnTop Mode with hearing aid programming
- Storing Data
- Verification to meet prescriptive targets

- Advanced
- Understanding fitting formulae
- AutoREM
- Verification of Open Fittings
- Counseling Tools
- Verification of hearing instrument features

Fitting with Aurical for Fitting Excellence

Using Aurical PMM / Aurical HIT in Fitting Process
Improved Work Flow Efficiency with Aurical

OUR PRODUCT LINE

- Product solutions for:
  - Fitting
    - Video Otoscope
    - Otocam 300
    - Audimeters
      - MADSEN Astera², AURICAL Aud
  - Probe Microphone Measurement
    - AURICAL PMM
    - Hearing Instrument TestBox
    - AURICAL HIT
AURICAL PMM HARDWARE ELEMENTS

FreeField Speaker
Free Fit Collar (worn by Patient)
Reference Microphone
Probe Microphone

Aurical HIT Components

Reference Microphone
Aurical HIT Speaker
Coupler Microphone (with BTE adapter)
Battery Pill Adapter

OTOsuite: Software that drives Fitting Process

Overview of OTOsuite
- OTOsuite synchronizes with the latest generation of Otometrics test devices and provides real-time presentation of test data
- Allows full test control from a PC
- Modules (NOAH / Standalone):
  - Video Otoscopy
  - Imittance
  - Audometry
  - OAE
  - Counseling & Simulations
  - PMM
  - HIT

Benefits of OTOsuite
- Improves workflow
  - One easy to use interface for different test modules
  - Computerized communication
    - Reduces time spent entering information and reduces errors
  - Provides counseling opportunities
  - Can facilitate testing protocols across clinics or even treatment rooms BUT can also customize specific user tests
- Ensures that equipment stays relevant
  - Hardware can be updated/upgraded via simple software updates
- Electronic data storage increases level of data security
PMM / HIT User Tests

- Allows for customization for advanced feature analysis (noise reduction, directionality, frequency lowering, feedback manager)
- Can have settings customized for PMM / Coupler Based Fittings
- Develop user tests for different fitting algorithms or manufacturer fitting levels

PMM in OTOsuite
OTOsuite view - Tabs related to different parts of PMM / Advanced Features

Probe Tube Calibration

Probe Tube Placement and Unaided Response
Targets Available within AURICAL PMM

Target Based Fitting
Guides settings for appropriate/optimized gain and output (Dynamic Real Ear Measurements)

Verify that your fittings are within target prescribed.

Can change between PMM/CBF
Can run all tests at once binurally

Close up View for a 65dB Input
- Solid Line = LTASS
- Dotted Line = Target
- Shaded Area = Percentile
Percentile Analysis

- It’s not just about the Long Term Average Speech Spectrum (LTASS)

- Also important:
  - the peaks of speech
  - the valleys of speech

- Helps you truly see how much of the signal fits into the patient’s available dynamic range, beyond simply the target.

EUHA/AHA, 2011.

The PMM Unit – “On Target” Mode

Allows clinician to quickly see LTASS relative to target which is normalized to “0” line

The PMM Unit—On Top Mode

MPO
Using the Coupler in Aurical HIT for Target Based Fitting

Coupler-Based Fitting: Fitting to Target

- Applies a new factor—individualized real ear to coupler adjustments.
- Measurements can be made in the HIT box when PMM isn’t feasible (e.g., children and difficult to test patients).
- Results in highly accurate predictions of hearing instrument performance, while considering individual ear variations.
- Allows programming and verification to be conducted under highly controlled conditions.
- Procedure is fast, efficient and reduces the degree of cooperation required from the client.

Real-Ear to Coupler Difference

- Assessment stage*: Used for HL to SPL conversion when insert phones are used - Correct estimation of SPL thresholds.
- Verification stage*: Used to transform Real Ear SPL to Coupler SPL values and vice - versa - Correct target calculation.
- Accuracy in threshold estimation and in coupler target calculation is just as relevant for adults as it is for pediatric clients!

*Moodie et al. 1994

The RECD is used in two places:

- HL Threshold + RECD + RETSPL = Real Ear SPL Threshold
- Coupler SPL or gain + RECD + MLE = predicted Real Ear SPL or gain

**The ‘RE’ in RECD**

- Probe tube Placement
- Ear Response

**The ‘CD’ in RECD**

- Can be measured without the client present.
- Can be stored in the probes so it doesn’t have to be repeated for each new client.
- **Coupler Response**
  - A. RECD coupling
  - B. BTE adapter tube
  - C. BTE (HA2) adapter
  - D. Transducer tubing
  - E. Transducer tube port

**Electroacoutic Analysis**

- OTOsuite view – ANSI electroacoustic measures (i.e. distortion) and Battery Drain
Integrated Fitting in HA Software

Phonak Target Match
** Can be completed with Aurical PMM / HIT **

How does Phonak TargetMatch help?
- It allows for verification using the Adaptive Phonak Digital formula
- It aids newer clinicians as they gain experience by simplifying the verification process via a guided workflow
- It provides a live real-time measurement of probe tube depth to overcome common concerns and objections
- It improves the verification process by automating the steps required to fit to target and by requiring only one software interface
- It improves fitting quality by applying acoustic transform measurements prior to target matching
- It monitors the ambient noise level in the fitting environment and adapts accordingly prior to applying gain changes
- It provides a unique and powerful tool to clinicians that reinforces Phonak’s commitment to helping them with their fitting challenges

What is required to get started with Phonak TargetMatch?
- Equipment: Aurical PMM and/or HIT
- Software:
  - Aurical PMM Only
    - OTOsuite 4.78 or higher; NOAH 4.4 or higher; Phonak Target 4.3.1 or higher
  - Aurical PMM and HIT
    - OTOsuite 4.82 or higher; NOAH 4.7 or higher; Phonak Target 5.1 or higher
  - Hearing Aid Models: V/B series (Hearing instruments made after January 2015)
- OTOsuite software is closed
- Final results are stored and viewable in OTOsuite and Target
- Audiogram can be measured via PC or manually entered in Noah Audiogram Module
- NOTE: FreeFit probes must have a valid calibration

Phonak TargetMatch workflow
- Located under “Global Tuning”
- Will be available once hearing aids are connected
- Seamless step by step workflow, aligned with common REM/PMM verification protocols
  - STEP ONE: Probe tube placement & REUG measurement
  - STEP TWO: Acoustic transformation measurement
  - STEP THREE: Target matching
TargetMatch probe tube placement tool

- Live measurement of distance to ear drum with indication of position of probe tube
- Move tube according to indication
- Use the markers on tube
  - ⬅️ = Unclear position
  - 🟢 = No reliable detection
  - ✔️ = Correct position

TargetMatch automated fitting screen

Advanced Feature Verification with Aurical

- A typical workflow is already laid out for you on the screen
  - Noise Reduction
  - FreeStyle
    - Directional Testing
    - Binaural Directional Testing
    - Frequency Lowering

Advanced Feature Assessment

Probe Mic Measures

- Prescriptive Target Based Fitting
- Speech Mapping
- Advanced Feature Assessment
Advanced Feature Assessment: Noise Reduction, How To

- Using the fitting software, program the hearing instrument for the desired Noise Reduction setting
- Configure the measurement buttons to compare the conditions you prefer (i.e., Off vs. On; or Mild vs. Strong)
- Select the time difference between the two measurements (ex: Second measurement after 14 seconds of noise).
- Click a measurement button in the control panel
- The snapshot curves are displayed in the graph and the overall noise reduction is displayed in the curve legend
- The F2B view gives you the opportunity to see and show the gain difference in an easy to understand graph
- Compare the two curves. If DNR is working the 2nd curve will demonstrate less gain and output than the curve initiated before DNR is engaged

Advanced Feature Assessment: Noise Reduction

The difference between the two curves can be used to determine if the noise reduction setting is appropriate for the client's signal-to-noise ratio (SNR) loss (as established via QuickSIN or other speech in noise procedure)

Advanced Feature Assessment: FreeStyle Tab

- FreeStyle is a dedicated demonstration section within PMM (real-ear or coupler/simulated real-ear)
- Numerous features can be demonstrated such as feedback managers, directional microphones, frequency lowering, wind noise, etc.
- Allows for easy comparison of curves run with features turned on/off
- Professional's sandbox to test the instruments

Advanced Feature Assessment: FreeStyle Tab Directionality

- **Directional Microphones—30 to 60 seconds**
  - Face the client (or hearing aid) away from the speaker
  - Make an initial measurement for a 65 dB speech signal with the HI in omnidirectional mode
  - Make a second measurement with fixed-directionality engaged (OR have fixed directionality engaged for both measurements and make measurement one with the client facing the speaker and measurement two facing away from the speaker)
  - Make sure adaptive features are OFF (ex: NR)
Advanced Feature Assessment: FreeStyle Tab
Directionality (Real-Ear/HIT)

Directional Microphones

Wireless Communication

- Ear-to-Ear Communication
  - CROS Mic
    - Requires E2E kit
- Wireless Accessories
  - Remote Microphone
  - TV Streamer

- E2E Verification Kit
  - Passive coupler
  - Two coupler adaptors

Verification of Wireless Accessories

- Verification procedures
  - Originally developed for FM technology
    - Remote Microphone
      - Transparency
      - SNR benefit
    - Streaming Device
      - Transparency only

Remote Microphone Verification – Step 1

- Open OTOsuite and select the User Test named “FM Reference Sequence - HI in AURICAL HIT”
- Click the “Sequence” button in the Control Panel to measure curves 1 and 3 (Reference) – curves will be identical
  - These curves will be identical because measurement settings are unchanged within the sequence
Remote Microphone Verification – Step 2

- Select the User Test named “FM Transparency & Advantage Sequence - HI outside AURICAL HIT”
- Raise the elevation plate in AURICAL HIT
  - Position the remote microphone and reference microphone
- Connect the coupler cable from the external accessory module to AURICAL HIT
  - Place the hearing instrument and coupler setup in the first coupler hole of the external accessory module

Remote Microphone Verification – Step 2 continued

- Click the “Sequence” button in the Control Panel to measure Transparency curve and FM Advantage curve
  - An ISTS input is presented to the remote microphone at 65 dB SPL for the transparency measurement
    - AAA tolerances (+/-2 dB) for acceptable transparency
  - For the SNR Advantage measurement, an 80 dB SPL ISTS input is presented
    - A 3 dB tolerance of the 10 dB target result is acceptable for FM advantage measures in most cases

Wireless Streamer Verification – Step 1

- Connect the computer line output to the streamer audio input.
- Navigate to the OTosuite sound library folder and open the ISTS signal for playback in a standard media player on the PC
- All Windows audio settings are set to a signal level comparable to the one of the TV, which usually corresponds to all wave file mixer settings on maximum volume. Remember to restore the original settings after this procedure.

Wireless Streamer Verification – Step 2

- Open OTosuite and select the User Test named “Streamer Verification”
- Click Button 1 named “Mic input” to start the measurement
- When the measurement completes, change the hearing instrument to the streaming program
  - Start the media player ISTS signal playback
  - Click Button 2 named “Streamer input” to start the measurement
  - Stop the measurement after 14 seconds.
- Compare the curves and make adjustments to streamer volume or hearing instrument programming
Advanced Feature Assessment: Frequency Lowering

User Tests for Frequency Lowering

- Stimuli options include pure tones / Ling sounds / environmental sounds
- Run comparison waveforms with frequency lowering activated versus deactivated
- Use F2B analysis to determine difference

Advanced Feature Assessment: Feedback Management

User Tests for Feedback Management

- Measure snapshot curves 1 and 2 with stimuli such as pink noise at 65 dB
- Run comparison waveforms with feedback management activated versus deactivated
- May use other stimuli options such as pure tones or environmental sounds

Resources: User Manuals

Press F1 in OTOsuite provides “content sensitive” information; Question Mark Icon provides global information or access full OTOsuite manual

Complimentary and Supplementary Info

www.otometrics.com
www.audiologysystems.com