Essential Components of the Pediatric Hearing Instrument Fitting Process

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Outline

• On the use of ‘Best Practice’ Protocols

• Resources

• Essential Elements for Pediatric Fitting in 2011
Infant Hearing Programs

Some thoughts on the need for ‘Best Practice’ clinical protocols
Ideally . . .

- Same equipment
- Same audiologic assessment procedures
- Same prescriptive procedures
- Same electroacoustic verification procedures, and so on . . .
Example

Hearing Instrument Fittings of Pre-School Children: Do we Meet the Prescription Goals?

Susan Strauss & Catherine van Dijk
International Journal of Audiology
2008
Method

• Measured the output from 20 children’s hearing instruments – total of 31 ears – moderate to profound hearing loss.

• Instruments fitted by a variety of clinicians.

• Compared the measured outputs to the DSLv5 prescribed levels for each child.
Results: 65 dB SPL speech input
Results: 65 dB SPL Input

- **Moderate Losses:** 34% had output values that were ±5 dB of the prescribed values.

- **Severe Losses:** 47% were within ±5 dB.

- **Profound Losses:** 34% were within ±5dB.
Results: 90 dB SPL narrow band input
Results: 90 dB SPL Input

• Moderate Losses: 34% had output values that were ±5 dB of the prescribed values.

• Severe Losses: 39% were within ±5 dB.

• Profound Losses: 92% were 5 dB or more below the DSLv5 target values for output limiting.
Resources for Pediatric Amplification

‘Best Practice’ Clinical Protocols from Around the World

http://www.mountsinai.on.ca/care/infant-hearing-program/health-professionals
British Columbia Canada

http://www.phsa.ca/AgenciesAndServices/Services/BCEarlyHearing/ForProfessionals/Resources/Protocols-Standards.htm

http://www.phsa.ca/AgenciesAndServices/Services/BCEarlyHearing/ForProfessionals/Resources/Training-Materials.htm
NEW ZEALAND

EUROPEAN NATIONS

http://www.biap.org
http://www.psych-sci.manchester.ac.uk/mchas/guidelines/fittingguidelines.doc
Additional Resources

Comprehensive Handbook of Pediatric Audiology

Richard Seewald
Anne Marie Tharpe

Pluralpublishing.com
Additional Resources

*A Sound Foundation Through Early Amplification: Proceedings of the 5th International Conference*  
August 2011 by Phonak AG

Essential Components of the Pediatric Hearing Aid Fitting Process
Modern Hearing Instrument Technologies

• Directional Microphones
• Frequency-lowering Technologies
• Feedback Control Systems
• Digital Noise Reduction
• FM-systems
• etc.
The Fitting Process

ASSESSMENT

SELECTION

VERIFICATION

VALIDATION
What we want to know . . .

That we have achieved a good match between the amplification characteristics of hearing instruments and the auditory characteristics of infants and children so that the use of their residual auditory capacity can be maximized.
Assessment Considerations for Fitting Infants and Young Children with Amplification
Component #1

We need ear-specific and frequency-specific threshold estimates for air and bone conduction before proceeding with the prescription and fitting of amplification for infants and young children.
Component #2

To fit hearing instruments accurately in the pediatric population (and to follow all current ‘best practice’ guidelines) we need to use a real-ear / hearing aid analyzer that implements the generic pediatric prescription procedures.

Why??
Component #3

We need to measure the external ear acoustics of the individual infant/child using the real-ear to coupler difference (RECD) procedure for the purposes of audiometry and hearing instrument fitting.

Why ????
Assumption:

The real-ear to coupler difference (RECD) values across frequencies are equal to those measured for an average adult.
RECDs in Infants: Key Points

- RECDs in infants and toddlers differ significantly from average adult values.
- RECDs vary from infant to infant.
- RECDs will change for a given infant over time.
The Real-ear to Coupler Difference (RECD)
A sample of RECD values for infants
Using the external ear acoustics, measured for the individual infant/child we are working with, we need to convert all audiometric data from dB HL to dB SPL in the ear canal.

Why?
To ensure that we have a good match between audiometric characteristics of the child and amplification characteristics of the hearing aid all variables we are working need to be defined using a common point of reference.
The SPLogram: In ear canal SPL
The Fitting Process

ASSESSMENT

SELECTION

VERIFICATION

VALIDATION
What we want to do. . .

To match the amplification characteristics of hearing instruments to the auditory characteristics of infants and children so that the use of their residual auditory capacity can be maximized.
Component #5

We need to use an evidence-based generic prescription procedure that has been developed specifically for application with infants and children (i.e. the DSL v5.0 method or the NAL-NL2 prescription procedure).

Available in:

• Manufacturer fitting software
• Real-ear / hearing aid analyzer system
Connect coupler and instrument to coupler microphone. Select one of REAR 1 through REAR 4.
The Fitting Process

- Assessment
- Selection
- Verification
- Validation
Component #6

We need to verify that the desired real-ear performance of the hearing instrument has been provided to the infant or child before they leave the clinic.

Why ??????
We need to know the levels of sound that a hearing instrument delivers into the ear of an infant or young child.

Consequently, comprehensive electroacoustic verification is an essential component in the pediatric hearing instrument fitting process.
How are RECDs used??

In Hearing Instrument Fitting

To predict real-ear hearing aid performance

HEARING AID PERFORMANCE + CUSTOMIZED TRANSFORM = HEARING AID PERFORMANCE

2cc COUPLER + INFANT’S RECD + MICROPHONE LOCATION EFFECTS

REAL-EAR
Connect coupler and instrument to coupler microphone. Select one of REAR 1 through REAR 4.
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The Fitting Process

- Assessment
- Selection
- Verification
- Validation
We need to measure and monitor auditory performance and communication development with amplification over time.

- objective measures
- subjective measures