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- Investigador pionero en el campo de la audiología y la adaptación pediátrica de audífonos
- Reconocido internacionalmente por crear el método de Nivel de Sensación Deseada (DSL) para la adaptación pediátrica de audífonos
- Director y editor de las actas de cuatro conferencias internacionales sobre tratamiento precoz de la hipoacusia en la infancia
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Protocolo de adaptación de audífonos en niños de 3 a 18 meses: prescripción y selección

Hearing instrument fitting protocol in infants from 3 to 18 months of age: assessment procedures
Protocolo de adaptación de audífonos en niños de 3 a 18 meses: adaptación y verificación

Hearing instrument fitting protocole in infants from 3 to 18 months of age: fitting and verification procedures
Hearing Instrument Fitting Protocol in Infants 3 to 18 Months of Age:

Assessment Considerations

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National Centre for Audiology
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The Fitting Process
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.
dB HL Threshold-based prescription

[Graph showing hearing threshold levels across different frequencies (250, 500, 1000, 2000, 4000, 6000, 8000 Hz). The graph displays levels of 70, 80, and 90 dB at various frequencies.]
Conventional Audiometry for Hearing Instrument Fitting

All of the variables we are working with are not defined in the same way or at the same location.
An Electroacoustic-Based Approach to Pediatric Fitting
The Electroacoustic-based Approach to Fitting (from Erber 1973)

- Child’s Level of Discomfort
- Maximum HA Output
- Amplified Speech
- Child’s Thresholds
- Conversational Speech
- Normal Hearing

Decibels Sound Pressure Level

- 140
- 120
- 100
- 80
- 60
- 40
- 20
- 0
Assessment Considerations for Fitting Infants and Young Children with Amplification

- Measuring Relevant Acoustic Characteristics
- Audiometric Assessment Considerations
Acoustic Transforms

Coupler \rightarrow\leftrightarrow\rightarrow Acoustic Transform \rightarrow\leftrightarrow\rightarrow Real-ear
The Real-ear to Coupler Difference (RECD)
The RECD Defined

Real-Ear Levels - Coupler Levels = RECD (dB)

RECD (dB) vs. Frequency (Hz)
Acoustic Transforms in Hearing Instrument Fitting

Assumption:

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

- Infant
- Average Adult

Frequency (Hz)

RECD (dB)

20 dB
A sample of RECD values for infants
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.
Measuring the RECD

Each child’s RECD values should be measured at the time of the:

1. audiometric assessment,
2. the initial hearing instrument fitting
3. and monitored over time.

Whenever earmold changes are made
But what if........
Updated Average RECD values

Real-Ear-to-Coupler Difference (RECD) Predictions as a Function of Age for Two Coupling Procedures

Marlene Bagatto, Susan Scollie, Richard Seewald, K. Shane Moodie, & Brenda Hoover
2002, JAAA, vol 13(8)
Predicted RECDs

DSL v4.1 predicted values:
- foam tip coupling only
- based on 12-month age ranges

Newly developed predictions:
- foam tip and earmold coupling
- to the nearest month
Predicted RECD Values

Subjects
- 392 infants & children
- ages 1 month to 16 years
- 141 ears used immittance tips
- 251 ears used earmolds
- normal otoscopic and immittance findings

Results
- high variability in RECD measures for children of the same age
Predicted RECD Values: Earmolds

- 500 Hz
- 1000 Hz
- 2000 Hz
- 4000 Hz

Graphs showing the relationship between age (in months) and RECD dB values at different frequencies.
Predicted RECD Values: Earmolds
Predicted RECD Values

Limitations:
- all subjects had normal middle ear function
- high variability in RECD measures associated with children of the same age

Therefore, whenever possible, predicted values should NOT replace a more precise RECD measurement.
The DSL Method uses the RECD to...

- Convert audiometric measures obtained using insert phones from dB HL to dB SPL in the ear canal.
- Convert gain and output limiting requirements in the real ear to 2cc coupler equivalents.
- Convert test box measurements of hearing instrument performance to estimated real-ear performance.
Assessment Considerations for Fitting Infants with Amplification

- Audiometric Assessment Considerations
Measuring Auditory Characteristics

"Appropriate hearing aid fittings in infants and children are dependent on valid audiologic test results. Results necessary for successful hearing aid fittings include ear-specific and frequency specific thresholds for air and bone conduction stimuli."
Acoustic Transforms in Audiometry

Audiometric Signal Transducers:

- Sound Field Loudspeaker
- TDH Series Headphone
- Insert Earphone
Assumption in Audiometry

Regardless of the signal transducer used in audiometry, the thresholds in dB HL will be the same.
For an average adult....
9 month old, in Sound Field...
For Sound Field Testing

[Graph showing frequency response with peaks at 2700 Hz and 6000 Hz.]
9 month old, TDH phones...
9 month old, insert phones...
RECDs for Infants and Toddlers

- Infant
- Average Adult

Frequency (Hz)

RECD (dB)

20 dB
Different Transducer, Different HL Thresholds

- Insert phones
- Sound Field
- TDH
A Solution to the HL Problem...
The SPLogram: In ear canal SPL
Behavioral Assessment

- Conducted with insert earphones
- Connect inserts to personal earmolds
How are the RECD values used?
In AUDIOMETRY with Insert Phones

To Predict Real-ear Thresholds in dB SPL

THRESHOLDS dB HL + CUSTOMIZED TRANSFORM = EAR CANAL THRESHOLDS dB SPL

HL to SPL (2cc) conversion + INFANT'S RECD
The SPLogram

Ear Canal SPL (dB)

Frequency (Hz)
The SPLogram (ABR data in dB SPL)
Summary:
What we need to fit amplification

- Ear specific and frequency specific threshold estimates (eHL) for air and bone conduction stimuli (tone-burst ABR, ASSR, VRA).
- Account for external ear acoustics in the assessment process (RECD).
- Using RECD measures, predict the ear canal SPL at threshold across frequencies.
- We can then move on to the prescription and fitting of amplification.