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- Investiga sobre la percepción del habla y el procesamiento auditivo en niños hipoacúsicos y sobre los resultados de los sistemas de amplificación y de las ayudas técnicas
- Miembro del comité ANSI para el desarrollo de normas para la evaluación electroacústica de ayudas técnicas
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Sistemas FM en bebés y niños pequeños

FM in infants

Use of FM Systems with Infants

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Early Identification, Diagnosis and Treatment of Deafness in Infants
Madrid, Spain
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NOISY CLASSROOMS


OPTIMAL ACOUSTIC SIGNAL


HEARING ACROSS DISTANCES


Oh Well, I give up!


I'm so confused!


I missed what you said!!

USE of FM SYSTEMS WITH INFANTS

Buenas Tardes!

University of Texas at Dallas

Callier Center for Communication Disorders

Advanced Hearing Research Center

Main Campus, Richardson, TX

Callier Center at Richardson

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www.utdallas.edu/~thib

What is YOUR perspective?

Otolaryngologists??

Audiologists??

Speech Language Pathologists??

Educators??

Parents??

Students??

Outline

- Rationale
- Available FM Technology
- Research
- Advantages/Disadvantages
- Summary

Rationale for Providing FM systems for Infants/Toddlers

Importance of Auditory Input

- Auditory input from birth is important for:
  - the neurological development of the auditory system
  - ability to process complex sounds
  - there is a "sensitive" or "critical" learning period in auditory development

(Ruben, 1997; Ruben & Schwartz, 1999; Sininger, Doyle, & Moore, 1999).

Effects of Hearing Loss

- Communication development in children with hearing loss is challenged, even with binaural amplification, by:
  - Noise
  - Reverberation
  - Distance
- With noise and reverberation, children may experience up to 30% reduction in speech recognition

  (Finitzo-Hieber & Tillman, 1978)

Hearing Loss Simulators

To Download the Hearing Loss Simulator go to

http://holmessafety.org/hlsim/

EARRING CD

Go to

www.utdalls.edu/~thib

Effects of Hearing Loss can be Significantly Reduced

FM Systems for infants allow for:

1) an increased signal-to-noise ratio for speech perception
2) increased parental acceptance of technology

(ASHA, 1991; Benoit, 1989; Madell, 1992; Moeller et al., 1996; Thibodeau & Schafer, 2002)

FM Demos

- Helpful to demonstrate for teachers, parents and administrators
- Can access on the web page or from the EARRING CD ROM on webpage
  www.utdallas.edu/~thib
- Recordings made in a room with typical Classroom Noise

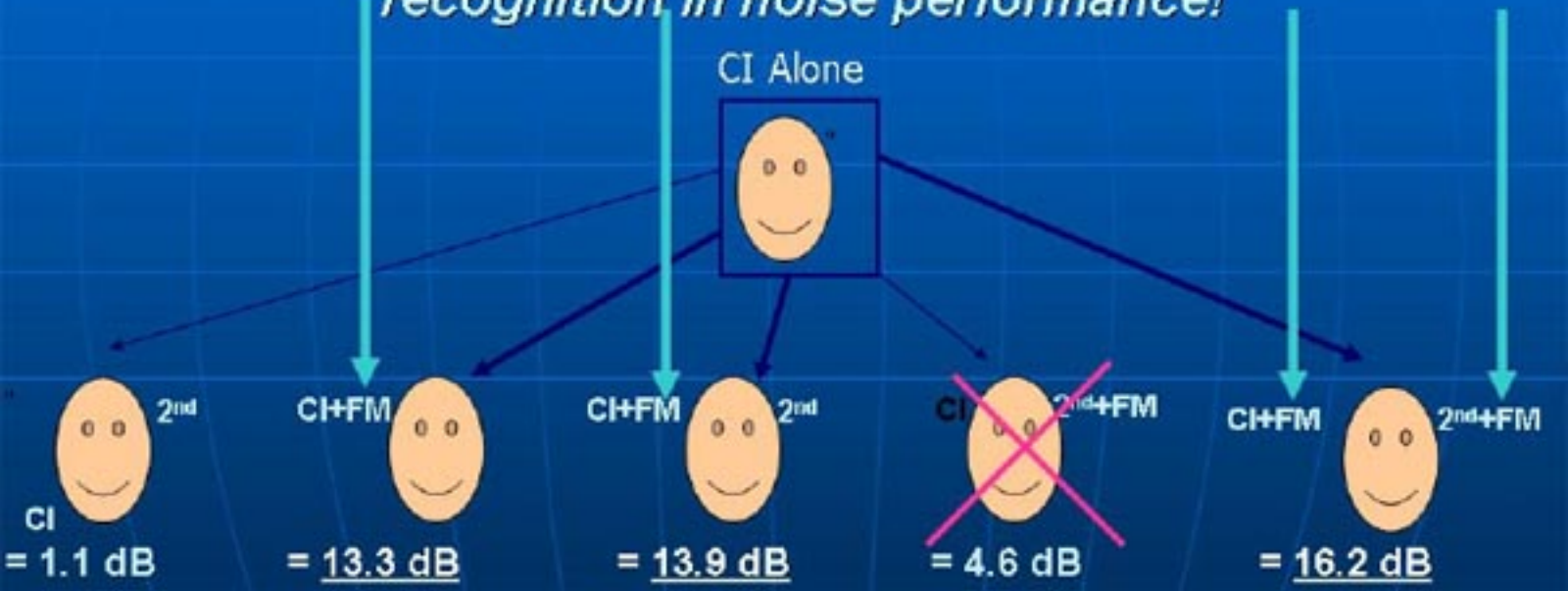
HA Only

HA+ FM

FM Study with Cochlear Implants/Hearing Aids

Schafer and Thibodeau (2006)

FM input to first or both sides allowed for best speech recognition in noise performance!



Improvements in speech recognition relative to CI Alone!

Limited Reports of FM Use with Infants/Toddlers

- Parents facilitate conversation more when wearing the FM and the children would imitate sounds more often.

  (Benoit, 1989)

- Some of the children using FM systems regularly in the home made significant progress in language development.

  (Moeller et al., 1996)

Early Work in our Lab

- Survey of Audiologists to determine FM use in infants
- FM Home Trial

Current Work in our Lab

- Survey of Parents who are using FM with infants
- FM Trial while riding in a Car

Survey of Educational Audiologists in the United States

- To obtain information regarding FM use in young children, a six-question survey was distributed via an email list-serve
- Despite a small return rate (N=14) there was strong support for use of FM

Results of Survey

- *86% indicated they fit FM systems on children birth to three years old*
- *On average, they were able to fit 60% of this population with FM systems*

Reasons to fit FM Systems for Infants

- Increasing audibility for language input
- Avoiding feedback
- Interfacing transmitter with audio sources
- Increasing communication in the car
- Closing the "distance gap"
- Increasing high-frequency gain
- Providing full access to primary care giver
- Providing access to toddler activities such as story-time at the library
- Increasing incidental learning

Reasons not to fit FM Systems on Infants

- Infants are already close to the speaker
- Lack of funding or experience with systems
- Lack of parental motivation
- Concern re: parental use in natural way
- Parental compliance/overload
- Restricted to non-FM compatible aid
- Interference with development of localization

Support for FM Use from Professional Organizations

American Speech-Language-Hearing Association (ASHA). (1991). The use of FM amplification instruments for infants and preschool children with hearing impairment

ASHA Guidelines for Fitting and Monitoring FM Systems (2002)

ANSI Standard for Evaluation of Hearing Assistive Technology (under Review)

American Academy of Audiology (AAA) Clinical Practice Guidelines *Remote Microphone Hearing Assistance Technologies for Children and Youth Birth-21 Years (under Review)*

Resources

- "Configurator" on Phonak Web Page

  www.phonak.com

  - Can put in HA type and get suggested FM arrangement
  - Can print instructions

Resources:

Phonak FM Fitting Guidelines for Cochlear Implants

Available FM Technology

FM SYSTEM BASICS

FM RECEIVER

FM TRANSMITTER

Frequency-modulated Signal
Assigned Frequency Channel

First BTE FM Systems

Not too practical for Infants

Behind-the-Ear FM Receivers available Today

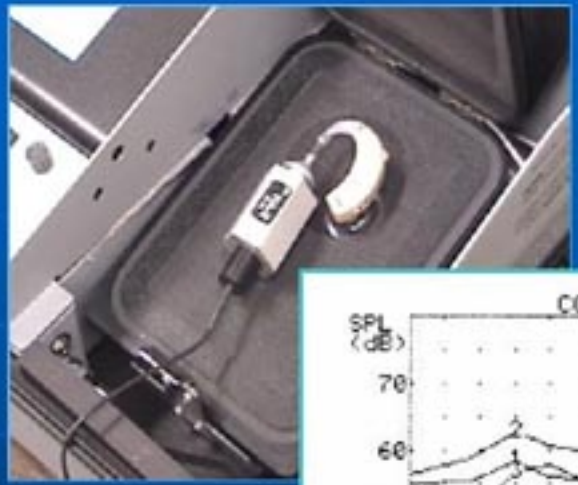
Audio Shoe with MLxS Receiver

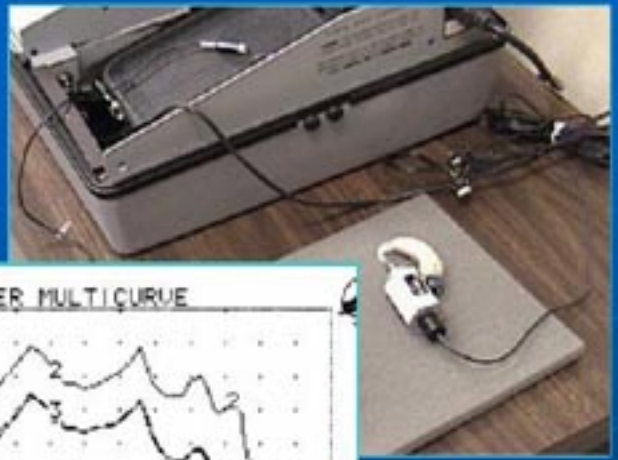
Built-in FM Receiver

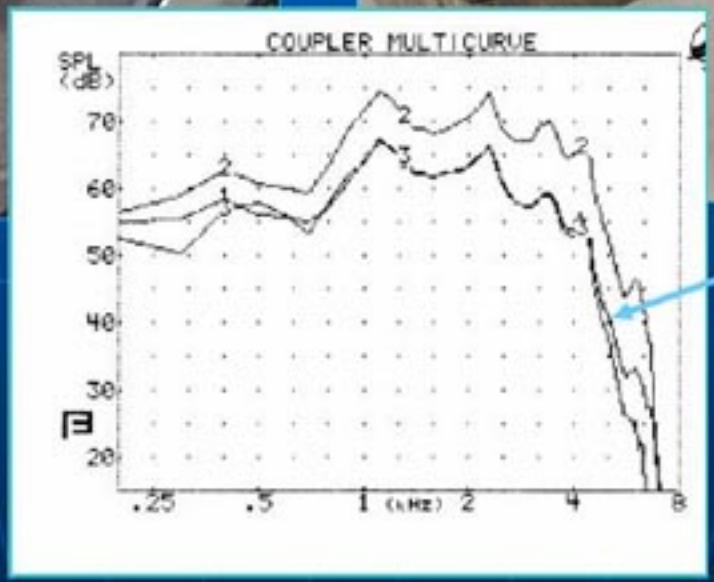
Audio Shoe with Micro MLxS FM Receiver

ML9s FM Receiver

FM Fitting with Electroacoustic Verification







HA and FM+HA Curves Match With 65 dB SPL Input

RESEARCH

Initial Study with Three Families

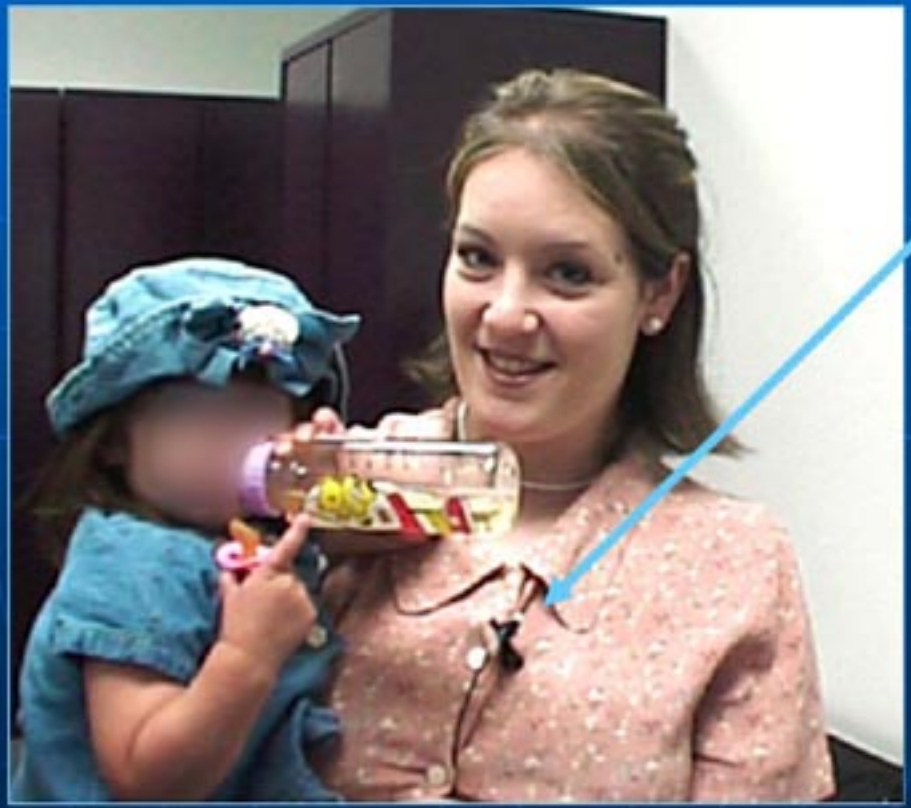
- Purpose: To determine the parent reported advantages and disadvantages of FM use in infants/toddlers through in-home trial.
- Phonak Boot FM Receivers coupled to binaural hearing aids. All had sensorineural hearing loss and had been wearing aids for at least 3 months.
- Parents were instructed in proper FM use and asked to wear FM transmitters all day.

  #1 - 2:9 years old, Mild to Moderate Loss
  Used FM +ENV Setting

  #2 – 18 months old, Severe to Profound Loss
  Used FM only Setting (limited by feedback)

  #3 – 2:10 years old, Moderate Loss
  Used FM + ENV Setting

Mother and Daughter with FM System



Parent observations noted in daily journal and interviews:

All noted following behaviors
- -increased searching for sound
- -more attention to sound
- -they increased their verbal input to child
- -increased interaction in noisy place such as riding in car, baseball games, stores

All were comfortable with
- -use and maintenance
- -responding to comments from general public about wearing the FM Microphone

Two of three reported child showed more interest in communicating

Individual observations included:

- Dancing to music on TV
- Singing with music
- Interacted more with sibling
- Kept aids on longer
- Followed directions better
- Imitated babbling
- Wanted to put aids on in the morning

Current Research

- Purpose: To evaluate Communication Interactions with infants and caregivers with and without FM while riding in the Car
- Video Recordings made in:
  - Step 1-Clinic: While mother reads script and child/noise set up to simulate car situation.
  - Step 2-Car: While mother speaks naturally during actual car ride.

Sample Recordings
22 mo old with Bilateral CI
No experience with FM Systems

In Clinic FM	Without FM	With Bilateral
Common Phrases		

In Car

Without FM

With Bilateral FM

Mother Report after four-day trial

Concerns re: FM for Infants

#1: One concern regarding consistent use of an FM system is that the child will become dependent on the improved SNR and therefore not respond well in noisier environments.

Increased speech and language stimulation will facilitate development of cognitive, social, and academic skills

Benefits outweigh unlikely Disadvantages

No evidence to support reduced speech recognition in noise after FM use.

Evidence re: Concern #1

- Teenager who wears bilateral hearing aids, but prefers FM Receiver on only ONE side
- Tested speech recognition in noise in each ear
- Speech Recognition in Quiet
  - poor in both ears (30%)
- Speech Recognition in Noise
  - Unable to test in ear with NO FM experience
  - Understood sentences 50% accuracy at +19 dB in ear WITH FM experience

Evidence re: Concern #1

- Children fit with trial Edulink had better speech recognition in noise than a control group who had no EduLink experience (Smart, 2008)

Concerns #2 re: FM for Infants

#2:The parent or Caregiver would use the system inappropriately by speaking to the child from a remote location allowing communication that wouldn't normally occur.

This is more likely a concern with older children where the parent may be tempted to use the FM system as a convenient way to call the child playing outside to come in for dinner, rather than going to the door and giving the appropriate visual stimulus with the auditory signal. When parents are instructed regarding appropriate use of the FM system and begin the process while the child is very young, these concerns may be minimized.

Concerns #3 re: FM for Infants

- #3: If the infant has a cochlear implant, you cannot listen to the FM to verify it is working. Because the infant can't respond, you can't be sure it is working.

Considerations re: Concern #3

This child can't see where she's going...but a mother could see that she is moving forward...she could observe her behavior!

Fuzzy Logic!

Infants can't tell you that the Cochlear Implant is working yet that didn't stop anyone from putting it on! We know from research that Implants work and how they should be programmed!

The FM components can all be verified with other equipment.

Considerations re: Concern #3

Then the parent/audiologist can watch the child for responses with the FM system just like they are watching for evidence of auditory perception through the cochlear implant.

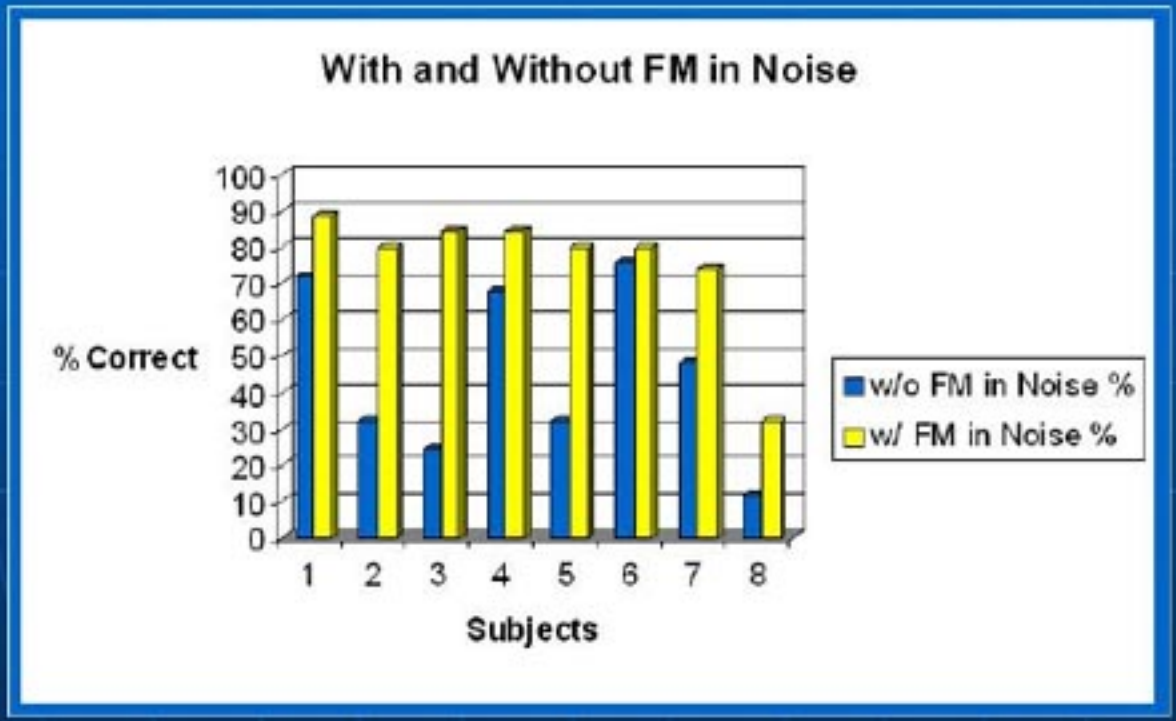
Several Cochlear Implant Processors allow for direct plug-in of FM receiver

Auria with Auria I-connect Adaptor & MLx-S FM Receiver

Freedom with Freedom FM Receiver

ESPrit 3G with MicroLink Adaptor and Phonak MLx-S FM Receiver

Evidence re: Concern #3



Thibodeau, Schafer, Overson, Whalen, Sullivan (2005)

SUMMARY

- We know from research with children and adults that use of FM systems results in increased speech recognition in noise
- Use of the system allows the parent/ caregiver to feel more connected to the child
- Parent/caregiver may feel more committed to the amplification process because they contribute by wearing the microphone.

SUMMARY

- The maturing infant receives the impression that wearing the device is very important as he/she sees the parent wearing the microphone.
- Paves the way for the child to learn that the FM system is a routine part of amplification so that when they begin school, they are well acquainted with the technology and its importance.

PEDIATRIC CHALLENGES

Challenges can make us uncomfortable!

But with coordinated support of professionals, manufacturers, and research teams, we'll all overcome these challenges with CONFIDENCE!


Preguntas?

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