The Role Of Electrocochleography In Predicting Speech Perception Outcomes in Adult And Pediatric Cochlear Implant Recipients.

Tatyana E. Fontenot MD, Andrew K. Pappa BS, William C. Scott BA, Kevin D. Brown MD/PhD, Douglas C. Fitzpatrick PhD

University of North Carolina at Chapel Hill, Department of Otolaryngology
Conflict of Interest Disclosure

Co-authors of this study have received research contracts and/or consult agreements with:

- MED EL Corporation
- Cochlear Corporation
- Advanced Bionics

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Our Research Team

Principal Investigator
• Douglas C. Fitzpatrick PhD

Surgeons
• Harold Pillsbury MD
• Kevin D. Brown MD/PhD
• Craig A. Buchman MD, Washington University in St. Louis
• Oliver F. Adunka MD, The Ohio State University

Audiologists
• Megan T. Dillon AuD
• Meredith L. Anderson AuD
• Lisa R. Park AuD
• Holly F. Teagle AuD

Residents and Students
• Tatyana E. Fontenot MD
• Andrew K. Pappa BS
• Christopher K. Giardina BS
• William C. Scott BA
There is wide variability in speech perception outcomes in CI recipients.
Electrocochleography (ECochG)

The measurement of stimulus-evoked cochlear potentials, with isolation of the potentials to the cochlea achieved by proximity through electrode placement in the ear canal, promontory, round window, or within the cochlea.
Electrocochleography (ECochG)
Electrocochleography and ECochG-TR

Response to 500 Hz stimulus:

A. CAP

B. Fast Fourier Transform

250 Hz  500 Hz  750 Hz  1 kHz  2 kHz  4 kHz
McClellan et al. 2014:  
Adults: 40% of variability  
$R^2=0.4$, $n=32$, $p<0.001$

Formeister et al. 2015:  
Children: 32% of variability  
$R^2=0.32$, $n=28$, $p=0.002$
Objective:

Compare ECochG-TR’s ability to predict speech perception outcomes in adult, prelingual and postlingual pediatric CI recipients.
ECochG-TR

Percentage of subjects with significant response

Frequency (Hz)

Prelingually deaf children
Postlingually deaf children
Adults

Adult (2.9±14.5 dB re:uV, n=95)
Prelingually deaf children (2.45±16.2 dB re:uV, n=66)
Postlingually deaf children (6.31±13.3 dB re:uV, n=62)

ECochG-TR (dB re:1uV)

Subjects

-40 -30 -20 -10 0 10 20 30 40 50 60

250 500 750 1000 2000 4000

Percentage of subjects with significant response

Frequency (Hz)

-40 -30 -20 -10 0 10 20 30 40 50 60

250 500 750 1000 2000 4000

ECochG-TR (dB re:1uV)

Subjects

0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100

250 500 750 1000 2000 4000

Percentage of subjects with significant response

Frequency (Hz)

-40 -30 -20 -10 0 10 20 30 40 50 60

250 500 750 1000 2000 4000

ECochG-TR (dB re:1uV)

Subjects

0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100

250 500 750 1000 2000 4000

Percentage of subjects with significant response

Frequency (Hz)
Why is ECochG-TR less predictive of speech perception outcomes in the pediatric populations?

• Adults started with normal hearing but have had progressive hearing loss over many years.
  » The hair cells and the spiral ganglion cells deteriorate at a roughly the same rate.

• In contrast, children are deaf for one of two reasons:
  » loss of hair cell activity=small ECochG-TR, good outcome
  » loss of neural activity=large ECochG-TR, poor outcome
Conclusion:

- ECochG-TR is significantly more reliable in predicting outcomes in adult CI recipients than pediatric CI recipients.
- Difference in pathophysiology of hearing loss in pediatric population compared to adults
- Why measure ECochG in children?
  - Rich source of information regarding hair cell and auditory nerve health.
  - Cochlear phenotype may relate to genetic causes of hearing loss.
Thank you!

Please visit:
Podium Presentation Session # S34 for more information on ECochG in adult CI recipients.
Podium Presentation Session # S38 for ECochG characteristics of ANSD.
Poster # 154-B for ECochG use in pediatric bilateral CI recipients.