Cortical development and reorganization in auditory deprivation.

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Disclosure

A. I have no relevant financial relationships with the manufacturer(s) of any commercial products(s) and/or provider(s) of commercial services discussed within this CME activity.

B. I do NOT intend to discuss an unapproved/investigative use of a commercial product/device in my presentation.
Aim

To investigate the time course of the deterioration, development and plasticity of the human central auditory pathway.
Auditory Evoked Responses

-reflect EEG activity in response to sound stimulation

-can be recorded non-invasively from all levels of the auditory pathways
P1 clinical testing. Children watch a DVD movie of their choice, CAEPs recorded to speech stimuli presented in soundfield.
P1 generators include the primary and secondary auditory cortex.

(Ponton and Eggermont 2001; Liegeois-Chuvel et al.,1994)
P1 latencies are an index of the maturation of the central auditory pathways.

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<th>Normal hearing children</th>
<th>Children with cochlear implants</th>
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<td>Sharma et al., 1997</td>
<td>Ponton et al., 1996</td>
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<td>Ceponiene et al., 1998; 2002</td>
<td>Eggermont and Ponton, 2003</td>
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<td>Eggermont &amp; Ponton, 2003</td>
<td>Singh et al., 2004</td>
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<td>Ponton, Eggermont et al., 2000, 2002</td>
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Cochlear Implant Subjects

- 245 congenitally deaf pediatric cochlear implant users

- Children ranged in age from 1 year to 18 years

- Age at implantation ranged from 0.75 years to 17.5 years

- Experience with implant ranged from 6 months to 8 years
There is a sensitive period of 3.5 years during which implantation occurs into a highly plastic central auditory system.

Sharma et al., Dec 2002; Ear and Hearing
Implantation after 7 years occurs into a re-organized central auditory system.

Sharma et al., Dec 2002; Ear and Hearing
Children implanted under ages 3-4 years show significantly better speech perception and language skills compared to children implanted after ages 6-7 years.

How rapidly does the auditory pathway change following the onset of stimulation for early implanted children?
What is the relationship between development of central auditory pathways and development of early communicative behavior?
Age of Implantation: 14 months

Sharma, Tobey et al., *Archives of Otolaryngology* 2004
Is plasticity absent in late implanted children?
Plasticity of the central pathways is greatly reduced in late implanted children.
Latency and morphology of the P1 CAEP serve as markers for the developmental status of the central auditory pathways in hearing impaired children.
P1 development following hearing aid fitting

Sharma et al., 2002
P1 development following cochlear implant fitting

Sharma et al., 2005
Problems to be solved

Scalp artifact in CI recordings

Gilley, Sharma et al., 2006 Clinical Neurophysiology
CAEPs are powerful objective biomarkers of central auditory system plasticity and maturation.

May serve as clinical indicators of central auditory development in children who receive intervention through conventional hearing aids and/or cochlear implants.
References