# Cortical development and re-organization 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.

***Normal hearing children***

Sharma et al., 1997

Ceponiene et al., 1998; 2002

Eggermont & Ponton, 2003

Ponton, Eggermont et al., 2000, 2002

Pang and Taylor, 2000

***Children with cochlear implants***

Ponton et al., 1996

Eggermont and Ponton, 2003

Singh et al., 2004

# 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

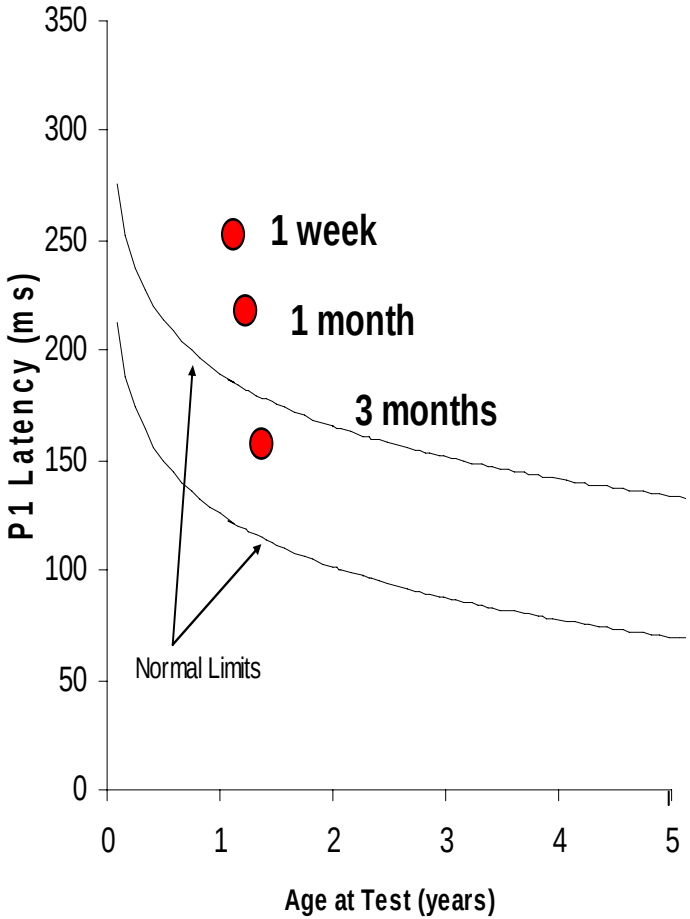
**Children implanted under ages 3-4 years show significantly better speech perception and language skills compared to children implanted after ages 6-7 years.**

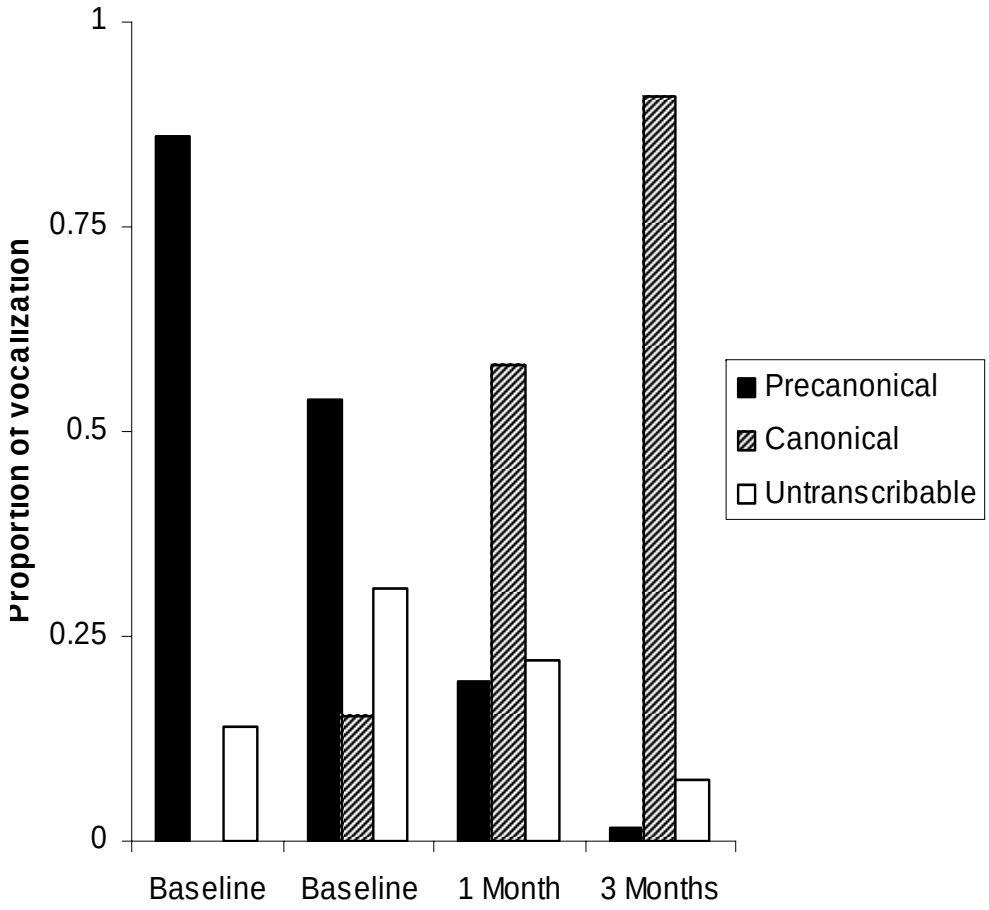
(Kirk et al., 2002; Summerfield, 2002, Manrique 2002, Waltzman and Cohen, 1998, Gantz et al., 1999)

**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 bio-markers 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.**

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