Move to hear and listen to perform.

On auditory stimulation through motor activities for deaf-born children with multiple functional deficits

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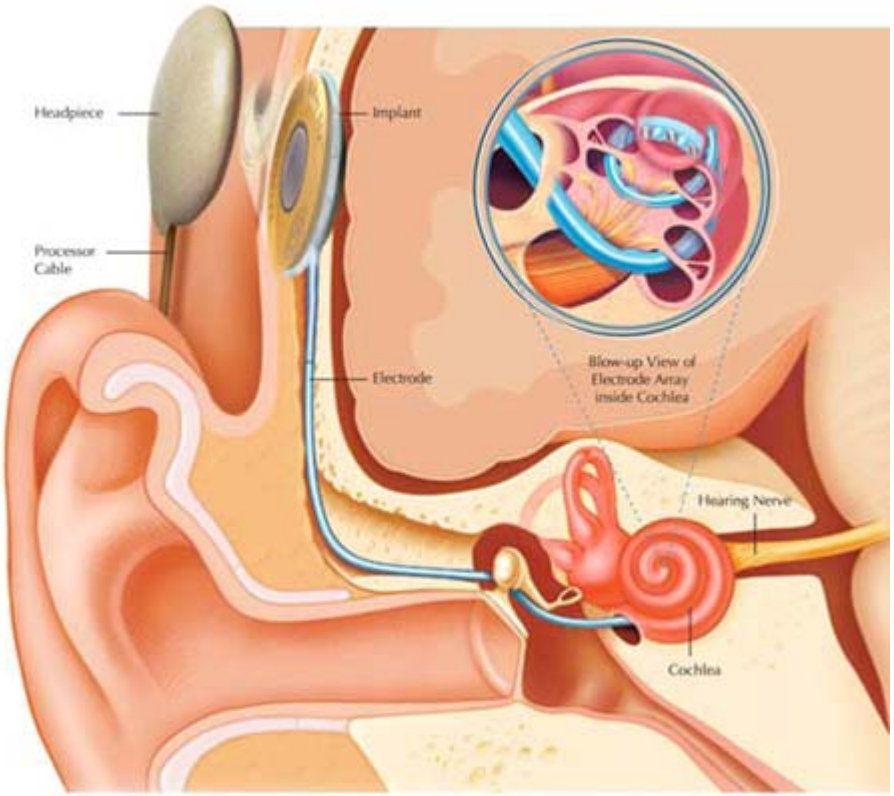
The technology – cochlear implants

- A substitute for the non-functional part of the auditory system (the hair cells of the cochlea)
- An electrode array is surgically inserted into the inner ear
- Sound is processed to an electrical stimulus pattern in an externally worn sound processor and transmitted to the array
- The pattern is transferred to the ganglion cells of the inner ear and further on into the auditory system

A cochlear implant



Programing

- Modern, higher-rate, multiple-electrode, sound-coding strategies are selective to promote reception of speech sounds

- Speech coding strategies may not fully exploit the perception abilities

- Post-lingually deafened adult CI users are not satisfied with their ability to perceive musical sounds
  - coding of pitch information for CI users is a major problem
  - rhythmical properties are well preserved
  - perception of timbre and melody is relatively poor

Pediatric implantation

- Early age
- Promote development within CNS
- ”Reprograming” and ”restructuring”
- Deaf-born children have no auditory experience and no auditory memories to facilitate the processing of the signal pattern
- Intensive habilitation of children aiming at oral language

Deaf children with artificial hearing

Deafness can be a part of a complex disability

Picture http://www.faqs.org

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Children….

- Who is a ”good” recipient?
- Earlier implantation leads to more CI-users with complex needs
- Deaf-born children with multiple functional deficits constitute a special vulnerable group with respect to the ability to make use of the input from the CI
- If speech is not the primary goal?
  - Non-speech sounds less audible
  - Little or no babbling due to motor problems

Rationale – if not speech; why?

- Motor actions linked to musical activities may have profound effects on organization of neural networks,
- May promote skills that are fundamental for a multitude of mental processes
  - concentration, motor control, attention span and self regulation
- Recreational - for the ”*LOL*”s

Ljudskrapan – the concept

- Allowing children with mental or physical disabilities to explore their hearing
- Consists of a hardware and a software part
- Designed to be used by parents and teachers

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Pilot study and results

- ”Ljudskrapan” has been tried by several children
- Early stages of mental development
- Report two ”typical” non-typical users of CI

Principle

- Provide the child with opportunities for auditory stimulation through motor activities

- Gesture sensors and various controllable sound models

- Reactions and feedback – obvious to caregivers
  - *Problem; lack of reactions often discouraging*
  - *Child depends on everyday use to develop auditory abilities*
  - *Use of CI often intermittent or CI discarded*

Sound library

- Software; collection of sound manipulation applications, possibilities for recording during sessions
- 100 recordings to choose from; sampled sounds
- Short-loop player use mainly; sounds of around 4-5s duration sound is endlessly looped
- Control parameters
  - *amplitude, loop frequency (pitch), loop starting point, loop length, and sound selection*

Control devices

- Various devices and sensors to the control parameters in the software:
  - *aiming devices*
  - *computer input devices*
  - *gesture sensors*
  - *MIDI instruments*
  - *microphones*


Kjetil wearing ”controlhat”

Boy 1

- Deaf born
  Diagnosis included moderate cerebral palsy, deafness and ASD

- Use of Sign language; no reactions to sound

- Reactions to ”Ljudskrapan”
  - *obvious reaction to sound – solid result*
  - *prefered some stimuli more than others*
  - *demanded (by sign language) recording of own name*

Boy 2

- Deaf born

  Diagnosis included cerebral palsy with no motor control of extremities but emerging head control, deafness

- Very early stage of mental development

- ”Ljudskrapan ” – multiple sessions
  - *Clear reaction to sound – new experience for caregivers*
  - *Obvious preferences (and dislike)*
  - *Impact on motor control and concentration*

Further on…

- Continue working….
- Extend to young children who do not have ”typical” development of hearing following implantation
- Extend work to children with cognitive disability and visual problems? ?