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Expanding Indications for Cochlear Implantation: Unilateral Hearing Loss

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Disclosures

- Research grant from MED-EL Corporation.

- CAUTION: Not FDA approved. Investigational Device Exemption.
Course Description

- This course will review the findings from a single-site investigation of cochlear implantation in cases of unilateral hearing loss, including the influence of cochlear implant use on speech perception, localization, and quality of life.

Learner Outcomes

As a result of this course, participants will be able to:

- Compare speech perception, localization, and quality of life outcomes in cochlear implant recipients with unilateral hearing loss when listening in an aided (CI on) and unaided (CI off) condition.
- Review the change in performance on sound field measures (speech perception and localization) with the cochlear implant over the first year of device use.
- Assess variables that may contribute to the outcomes observed in the study cohort.
Outline

- Cochlear implantation in cases of unilateral hearing loss clinical trial
  - Subject cohort
  - Protocol
- Study results
  - Speech perception
  - Localization
  - Quality of life
- Review device and subject variables

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Unilateral Hearing Loss (UHL)

- Challenges of UHL compared to normal hearers:
  - Poor speech perception in noise (Welsh et al., 2004)
  - Variable ability on localization tasks (Slattery & Middlebrooks, 1994)
  - Increased report of hearing handicap (Iwasaki et al., 2013)
  - Reduced quality of life (Wie, Pripp, & Tvete, 2010)

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Unilateral Hearing Loss (UHL)

- Treatment options
  - Conventional HA
  - Bone-conduction devices
  - CROS hearing aid system

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Unilateral Hearing Loss (UHL)

- Limitations
  - Ability to use binaural cues for speech perception in noise is variable (Kunst et al., 2007)
  - Localization abilities have been found to be at chance (Bosman et al., 2003; Hol et al., 2010)

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Cochlear Implants

MED-EL Corporation

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CI in UHL

- Considerations for cochlear implantation in UHL:
  - Ability to integrate acoustic and electric stimulation when one ear has normal hearing?
  - Distraction of the better-hearing ear?
Clinical Trial

- Cochlear Implantation in Cases of Single-Sided Deafness

- **Primary Aim**: determine whether subjects with UHL/SSD experience an improvement in speech perception, localization, and quality of life with a cochlear implant as compared to an unaided listening condition.

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Protocol

- **Timeline**
  - Preoperative evaluation
  - Cochlear implantation
  - Initial activation
    - 2-4 weeks postoperatively
  - Follow-up intervals
    - 1, 3, 6, 9, and 12 months

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Protocol

- Test Measures
  - Speech perception
    - CI-alone
    - CI+NH
  - Localization
  - Quality of life

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Protocol

- MED-EL Concert Standard electrode array
- Ear-level device
- FS4 coding strategy
- Mapping procedures
  - Thresholds versus comfort levels
  - Loudness balancing across all channels
  - Overall loudness balancing

CAUTION: Not FDA approved. Investigational Device Exemption.
Study Cohort

- 20 adults with moderate-to-profound SNHL in the affected ear
  - Mean duration of hearing loss: 3 years
  - Mean aided CNC word score: 22%

- Normal to near-normal hearing in the contralateral ear
  - ≤ 35 dB HL, 125-8000 Hz

- Mean age at implantation: 50 years

Study Findings

Expanding Indications for Cochlear Implantation:
Unilateral Hearing Loss
Speech Perception: CI-alone

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Figure 2, Buss et al. (2018)

Speech Perception: CI+NH

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Figure 3, Buss et al. (2018)
Localization

- 200-ms speech-shaped noise bursts
- Randomized speaker and signal level
- RMS error

Figure 4.a, Buss et al. (2018)
Quality of Life

- Abbreviated Profile of Hearing Aid Benefit (APHAB)  
  (Cox & Alexander, 1995)

- Speech, Spatial, & Qualities of Hearing Scale (SSQ)  
  (Gatehouse & Noble, 2004)

- Tinnitus Handicap Inventory (THI)  
  (Newman, Jacobson, & Spitzer, 1996)

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Figure 2, Dillon et al. (2018)
Quality of Life: SSQ

Figure 3, Dillon et al. (2018)

CAUTION: Not FDA approved. Investigational Device Exemption.

Quality of Life: THI

Figure 1, Dillon et al. (2018)

CAUTION: Not FDA approved. Investigational Device Exemption.
Summary

- CI in UHL subjects demonstrated significant improvements in:
  - Speech perception with the CI-alone
  - Speech perception in spatially-separated noise when listening with the CI+NH
  - Localization when listening with the CI+NH
  - Quality of life

Discussion

- Variables that may contribute to performance
  - Duration of UHL
  - Contralateral ear
  - Electrode array
  - Coding strategy
  - Mapping techniques
  - Aural rehabilitation
  - Daily device use
  - Listening environment
  - Motivation
  - Realistic expectations
Thank you
Expanding Indications for Cochlear Implantation:
Unilateral Hearing Loss

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