Cochlear Implantation as a Rehabilitative Option for Single-Sided Deafness

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Disclosure of Financial Relationships: Dr. Gantz is a consultant for Cochlear and Advanced Bionics. Dr. Dunn is a consultant for Med-EL. There are no other disclosures.
SSD Background

- Up until more recently, CI has not been considered treatment option
  - Assumed that individuals could function with the better ear alone
  - However, some report significant difficulties in speech understanding that interferes with their quality of life (Wie, Pripp, & Tvete, 2010).
Current Treatment Options

1. BICROS (Bilateral Contralateral Routing Of Signals) or CROS hearing aid (Harford, 1966)

2. Osseointegrated system
   - Overcome the effect of the head shadow
   - When speech is at the better hearing ear, the addition of any noise received by the auxiliary microphone will degrade intelligibility (Dillon, 2001).
   - No directionality
Cochlear Implantation as Treatment for SSD

• Possibility of restoring binaural hearing sensitivity

• Recent studies have been motivated by unilateral tinnitus associated with unilateral deafness
  
  – Reported benefits for speech perception, particularly in noise, in addition to the suppression of tinnitus (Arndt et al., 2011; Buechner et al., 2010; Van de Heyning et al., 2008; Vermiere & Van de Heyning, 2009).
Subjects

- 50 patients have undergone CI for SSD
  - Mean age at implantation = 53.06 years (1.59 SE)
  - Duration of hearing loss = 3.7 years (0.6 SE)
  - Females (51%)
- Devices
  - Cochlear = 29
  - Advanced Bionics = 16

University of Iowa IRB approved the study
IT, gent, Other, Ménière's (Stage IV), ISSNHL, Etiology

- Explosion
- Otosclerosis
- Head Injury
- IAC Lesion

- Tumor 10%
- Other 12%
- Menières 42%
- ISSNHL 36%
Testing

- Data collected pre-operatively and post-operatively at 3, 6, 12 months, and annually
- Pre- and post-operative data collected on 39 subjects
  - AzBio in quiet
  - CNC in quiet
  - HINT in noise
  - Localization
- Unilateral testing completed using Direct Connect.
CNC Words

% Correct

SSD

CL+CL

CL Only

Dunn et al. 2008

Pre

Most Recent

The University of Iowa
Adaptive HINT in Noise
Head Shadow Effect
Noise facing better ear

Signal/noise ratio

Bilateral  Better Ear

* simultaneous CI and laby
Lower score represents better ability

Avg Normal Ear Only = 41 degrees (SE 1.4)
Avg Bilateral Hearing = 27 degrees (SE 1.3)
Variability

• A lot of variability in performance with this group
  – Typical of cochlear implant data

• Why do some do well and others not so well?
Not sure we have the answer yet

• What have we looked at?
  – Pre implant hearing
    • Ear implanted and contralateral
  – Duration of hearing loss
  – Device Type
  – Etiology
  – Data logging
Conclusion

• Many patients with SSD who receive a CI have improvements with sound localization and speech perception in background noise.

• A lot of variability in performance
  – Amount of daily use
  – Etiology

• The data reported here, coupled with recent reports, raise the possibility of restoration of binaural auditory perception via cochlear implantation.
Acknowledgement

• Research grant 2 P50 DC00242 from the National Institutes on Deafness and Other Communication Disorders -- National Institutes of Health

• The Lions Clubs International Foundation and the Iowa Lions Foundation.
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