Introduction

Binaural Processing
- Integration of acoustic information at the two ears
- Encodes two important acoustic spatial cues:
  - Interaural Time Differences (ITDs)
  - Interaural Level Differences (ILDs)

Spatial Hearing Abilities
1) Sound localization
   - Identifying the location of a sound source
   - For broadcasts, signals, or speech
   - In noise, more difficult

2) Speech reception in background noise
   - Spoken words
   - Hearing sentences

The current study aimed to:
1) Evaluate the CiPDA research platform for free-field psychoacoustic testing
2) Assess spatial hearing benefits of synchronized bilateral stimulation

CIPDA Research Platform
- Experimental device designed to link BiCIs

Capabilities
- Single processor drives both implants
- Synchronized bilateral stimulation
- Use of Cochlear Nucleus® devices

Features
- Real-time ACE processing
- Mimics clinical processors
- Use patient’s clinical maps
- May provide better ITD transmission
- Enhance ITDs
  - Temporal Fine Structure ITDs

The problem for Bilateral Cochlear Implant (BiCI) users
1) Sound localization
   - Users report difficulty identifying sound sources
   - Larger localization errors compared to normal-hearing listeners

2) Speech reception in background noise
   - Users report difficulty hearing in noisy environments
   - Speech signals are more difficult to perceive

Binaural limitations of current BiCIs
- Current devices operate independently of one another
- Stimulation between implants is not coordinated
- May provide better ITD transmission

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2) Assess spatial hearing benefits of synchronized bilateral stimulation

Participants

Listeners
- Post-lingually deafened CI users
- Male and female
- Age range: 18-62 years

Procedures
Getting Started
1) Load patient's clinical maps onto the CiPDA
2) Place RF coils onto patients
3) Turn device on and start real-time processor
4) Ensure patient can hear testing stimuli

Sound Loudness Matching
1) Start with CiPDA default settings and clinical processors in the patient's everyday program
2) Adjust (lower) CiPDA sensitivity to reduce background noise
3) Adjust CiPDA left and right volume to ensure a perceived center for a stimulus played from 0° azimuth
4) Test with four pink noise bursts (each 170ms)

Speech-in-Noise Performance

Stimuli
- Combination of IEEE sentences
- A dialog consists of 50 words
- Male speaker

Procedure
- Target and masker presented in two conditions:
  - (A) co-located or (B) symmetric separation
  - Four total adaptive tracks were measured for each condition
  - Patients selected perceived word from a list of 50 words

CONCLUSIONS
- The CiPDA research platform is effective for testing spatial hearing in the free field
- The CiPDA can acutely produce comparable listening performance as provided by the patient’s clinical processors
- Synchronizing pulsatile stimulation across the ears alone does not result in improved sound localization performance
- Novel strategies aimed at improving sound localization can be implemented and tested using the CiPDA

Spatial release from masking was observed when listening with the CiPDA suggesting that coordinated stimulation may provide useful information for segregating spatially separated sound sources.