Effect of Channel Interactions on ITD Sensitivity in Bilateral Cochlear Implant Users

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ABSTRACT

We examined ITD sensitivity in Nucleus-24 BICI users with bilateral cochlear implants who had undergone bilateral cochlear implant surgery at least 2 years prior to testing. ITD sensitivity was measured for a 100 pps simple pulse train probe that was presented to the Nucleus-24 at ITD JNDs (us) were measured for a 100 pps simple pulse train probe that was presented to the Nucleus-24 at ITD JNDs. Sensitivity to the ITD of the probe signal was worse for some subjects than others, and this effect was observed in both ears. This suggests that the ITD sensitivity in BICI users may be affected by factors such as electrode separation or on a single electrode pair, which could influence the ITD sensitivity in bilateral cochlear implant users. Therefore, it is important to consider these factors when assessing ITD sensitivity in BICI users.

METHODS

Subjects: In bilateral cochlear implant users (BCI), how is ITD sensitivity different from that in normal hearing individuals? (simple sound source scenario)

Results:

Expt. 1: Common ITD

Hypothesis: ITD sensitivity will be reduced when conflicting ITDs are present in the two ears. Sensitivity in bilateral cochlear implant users (BICI) was assessed in the presence of an added signal. The added signal was presented to the BICI user at ITD JNDs and compared with cases in which the ITD of the probe and added signal are the same.

Expt. 2: Conflicting ITD (mid-line)

Hypothesis: ITD sensitivity will be reduced when conflicting ITDs are presented to two nearby pitch-matched pairs of electrodes. With increasing electrode separation or decreasing level of the added signal this reduction in sensitivity may be attenuated or eliminated.

Expt. 3: Conflicting ITD (side)

Hypothesis: ITD sensitivity will be reduced when conflicting ITDs are presented to two nearby pitch-matched pairs of electrodes. With increasing electrode separation or decreasing level of the added signal this reduction in sensitivity may be attenuated or eliminated.

QUESTIONS

1. When both electrode pairs are presented with the same ITD cues? (single sound source scenario)

2. When the two electrode pairs are presented with disparate ITD cues? (multiple sound sources)

3. As a function of the spatial separation and relative stimulation levels of the two electrode pairs?

REFERENCES


CONCLUSIONS

1. Activation of multiple channels may be necessary to reduce ITD sensitivity.

2. Performance is typically degraded when conflicting ITDs occur (on two pairs of electrodes on a single electrode pair).

3. The effect of electrode separation is complex and involves several cases. ITD and IAD were measured for a 100 pps simple pulse train probe that was presented to the Nucleus-24 at ITD JNDs. Sensitivity to the ITD of the probe signal was worse for some subjects than others, and this effect was observed in both ears. This suggests that the ITD sensitivity in BICI users may be affected by factors such as electrode separation or on a single electrode pair, which could influence the ITD sensitivity in bilateral cochlear implant users. Therefore, it is important to consider these factors when assessing ITD sensitivity in BICI users.

4. The size of the competing ITD cue affects the sensitivity to the ITD of the probe. However, individual subjects varied with regard to which ITD size (center or side) is more disruptive of ITD sensitivity.

5. Effect of interaction is reduced with decreasing channel level of the added signal.

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