

Sound localization in sequential cochlear implant users. Preliminary results from a multicentric longitudinal study

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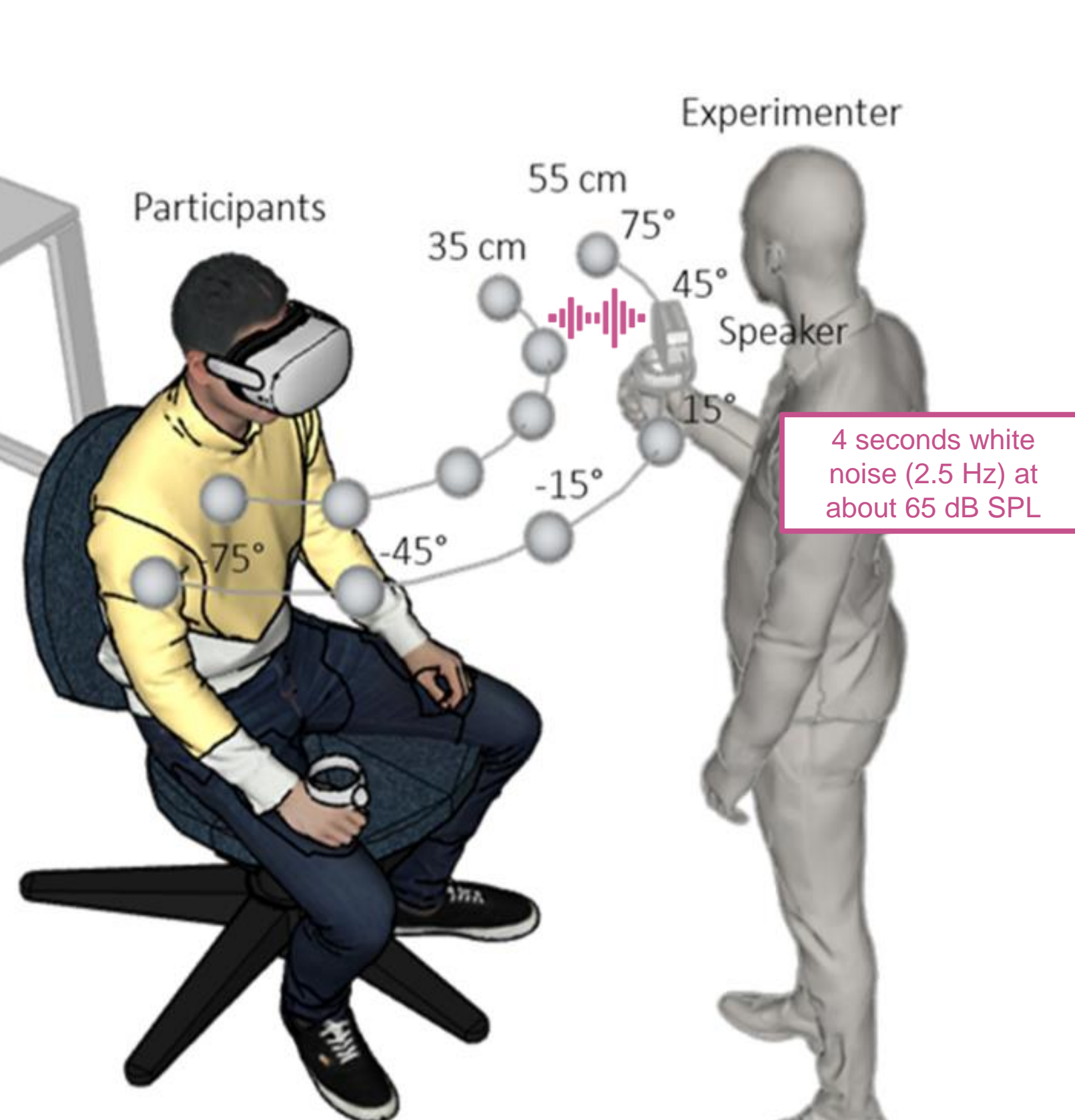
Abstract

The benefit of bilateral cochlear implantation for spatial hearing is a well-established finding. Yet, research has primarily compared performance of unilateral CI (UCI) vs. bilateral CI (BCI) users, or tested BCI when one vs. both CI were active. Because only a few studies addressed this issue using a longitudinal approach, we have limited understanding of the time course of adaption to restored binaural hearing. Here we present preliminary findings from a multicentric study aimed at testing spatial hearing in CI patients before receiving their second CI, and at three follow-up points post-surgery (1 month, 3 months, >6 months).

Aim

WHAT IS THE TIMELINE FOR THE DEVELOPMENT OF SOUND LOCALIZATION ABILITIES AFTER THE SECOND COCHLEAR IMPLANT?

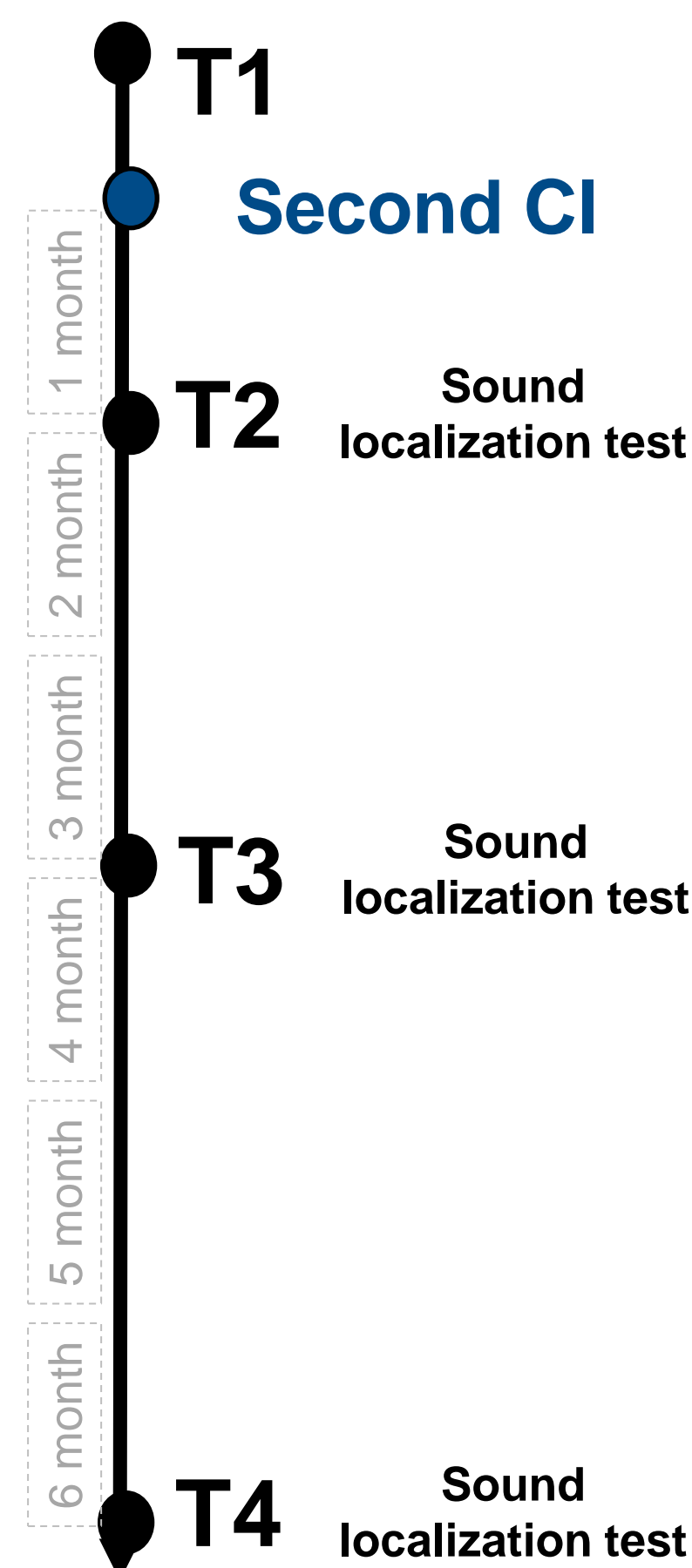
Materials and Methods



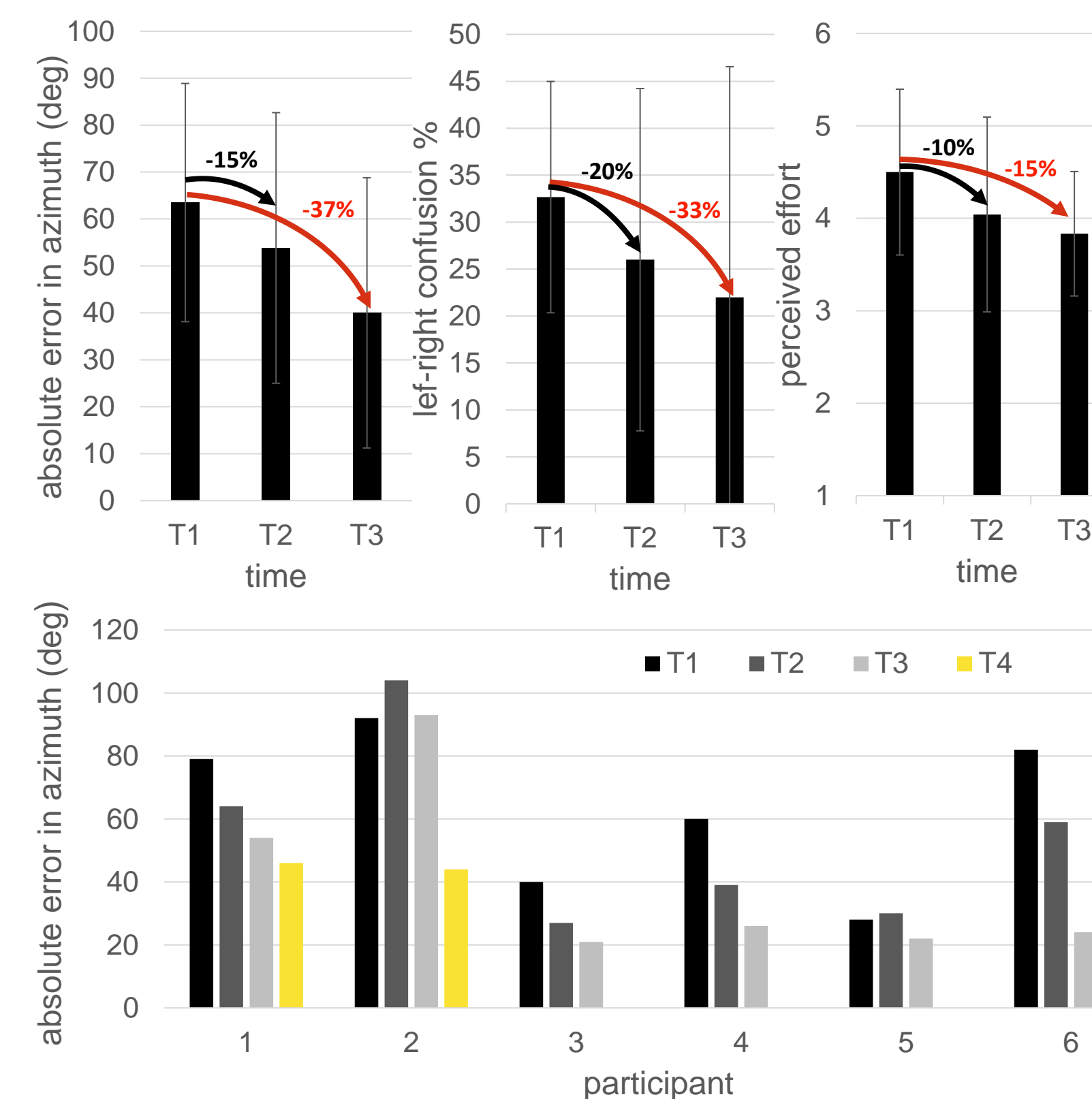
Participants 6 CI recipients

Patients had mixed onset (early and late deaf) and mixed aetiology, no history of neurological or psychiatric problems. All had at least 70% recognition in quiet of bisyllabic words with the first CI alone, modiolar array cochlear implant and a processor Cochlear brand model CP900 or later, more than 10 years age at the first CI.

We focused these preliminary analyses on the temporal evolution of participants' performance in azimuth, as localization along this dimension is particularly influenced by changes in binaural cues.



Results



- When listening with a single CI the average **absolute error** in azimuth was $64^{\circ} \pm 25^{\circ}$. At 1 month after the second CI, the BCI advantage was already reduced in 4 out of 6 patients (mean error $54^{\circ} \pm 29^{\circ}$; -15% change with respect to the UCI experience). Importantly, the BCI advantage consolidated at 3 months in 5 out of 6 patients (mean error $40^{\circ} \pm 29^{\circ}$; -37% change).

- This advantage in absolute error was accompanied by an average reduction of **left-right confusion** errors (UCI = $33\% \pm 11\%$; 1 month = $26\% \pm 17\%$, -20% change with respect UCI; 3 months = $22\% \pm 22\%$, -33% change), and in 4 out 6 patients in a reduction in perceived **effort** in sound localization (UCI = 4.5 ± 0.9 ; 1 month = 4.0 ± 1.1 , -10% change; 3 months = 3.8 ± 0.7 , -15% change). Changes in the patient's confidence in sound localisation remained instead largely unchanged.

- in the two patients who were also tested after >6 months average absolute error reduced progressively (patient 1: UCI = 79° , 1 month = 64° , 3 months = 54° , 9 months = 46°) or made a significant change only at the last testing session (patient 2: UCI = 92° , 1 month = 104° , 3 months = 93° , 9 months = 44°).

Conclusion

These preliminary results indicate that changes in spatial hearing skills in sequential CI use can be expected soon after BCI surgery (1 to 3 months). Yet, a clear tendency towards consolidation emerged, indicating the importance of adaptation to binaural cues. They corroborate the notion that BCI improves spatial hearing and expands current knowledge by providing initial evidence of the time course of adaption to restored binaural hearing.

References

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