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Cl1 ears had lower mean SRT than Cl2 ears at two years post-Cl2. In addition, SRT for both ears improved as a function of time post-Cl2. These observations were statistically confirmed. Both the inclusion of ear ($\chi^2 = 5.46, df = 1, p < 0.05$) and time post-Cl2 ($\chi^2 = 37.84, df = 1, p < 0.0001$) caused significant reductions in model deviation. A greater change was seen for Cl1 ears (8.1 dB) compared to Cl2 ears (6.4 dB). However, after four years post-Cl2, Cl1 ears still had lower mean SRT than Cl1 ears.

Conclusions
Speech recognition in quiet and noise and release from masking improved between two and four years post-Cl2. The contribution of Cl2 improved more than that of Cl1 with regard to SRTs, resulting in more symmetrical benefit. This information may be useful in counselling children who struggle to make consistent use of a sequential implant, to encourage them that their listening can continue to improve over the longer term with practice. It also highlights the potential benefits of a Cl1, even for children with up to 95 months of unilateral Cl1 use.

Methods
Participants: We identified 17 congenitally deaf children reported to be consistent users of both a first (Cl1) and sequential (Cl2) cochlear implant. Each child had aided thresholds bilaterally of 35 dB HL or better from 0.25 to 6 kHz and had participated in spatial listening assessment at two and four years post-Cl2. Inter-implant intervals ranged from 19 to 95 months (median = 49 months).

Assessments: Assessments were performed at two and four years after children received their second cochlear implant. Tests were administered via the AB-York Crescent of Sound 3. SRTs were measured using the adaptive McCormick Toy Discrimination Test 4 monaurally in quiet and binaurally with pink noise. Words were presented from directly ahead and noise from 0°, +90° and -90° (see Figure 1). Children listened to the introductory phrase “point to the” followed by the name of one of ten to fourteen phonemically paired toys, e.g. “tree / key”. SRM was calculated in decibels as the improvement in binaural speech reception threshold for noise coming from each side compared to noise coming from directly ahead i.e. $\text{SRM}_{\text{Cl1}} = \text{SRT}_{\text{SN0}} - \text{SRT}_{\text{SN1Cl2}}$ and $\text{SRM}_{\text{Cl2}} = \text{SRT}_{\text{SN0}} - \text{SRT}_{\text{SN2Cl1}}$.

Analysis: Data were analysed via two-level hierarchical regression models with the levels of the model being measurement (within-participant) and participant (between-participant). For each dependent variable (SRT in quiet, SRT in noise and SRM) a series of models were used to explore the effect of explanatory variables (i.e. time post-Cl1, implanted ear and noise location). For multiple hypotheses testing a Bonferroni-corrected significance level of $p < 0.01$ was used. For SRTs in quiet and noise lower values represent better performance. For SRM higher values represent greater ease of listening when noise is spatially separated from the speech signal.

References