

**Supplemental Material S1.** Characteristics of studies on the prognostic value of NRT and eCAP for CI outcomes.

Study Country	Study design	Diagnosis	Number of Participants: total, girls	Age, mean or range (years)	Age at CI (months)	Device	Uni/Bi	Follow-up period (months)	Electrophysiology	Outcome measures	Findings
Motasaddi Zarandy 2018 (Iran)	Pros	SNHL	10, 7	3-5	50.4	Nucleus	All Uni	6	Postoperative NRT	Newsha development al scale	Improvement in speech and language scores post-implantation despite no change in eCAP hearing thresholds.
Attias 2017 (Israel)	Pros	ANSD Matched SNHL	ANSD: 16, 6 SNHL: 16, 8	ANSD: 5-12.2 SNHL: 6.7-13.2	ANSD: 11-34 SNHL: 10-26	Majority with Nucleus, AB, MedEl	ANSD: 6/10 SNHL: 8/8	40	Postoperative eT, eCL, eDR, and tNRT only in Nucleus CI users	MWT, SWT, and EST in quiet and noise	Despite reduced eT, eCL, eDR, and tNRT in children with ANSD, they showed no difference from children with SNHL in speech performance outcomes.
Jeong 2013 (Korea)	Retro	ANSD	15, 5	3.5	70	Nucleus	NR	72.08	Postoperative eCAP (3 weeks postsurgery)	CAP, IT-MAIS, open-set MWT	Better speech perception abilities were observed in children with robust eCAP results.
Valero 2012 (Canada)	Retro	CND (hypoplasia) Matched SNHL	19, 10	NR	Hypo-plasia: 50.4 (12-155) SNHL: 51.24 (12-172.2)	Nucleus	Hypo-plasia: 17/2 SNHL: 17/2	At CI activation and every 3 months up to 24 months	Postoperative eCAP	ESP, IT-MAIS, WIPI, GASP, MLNT, BKB words, LNT phonemes, BKB phonemes	In children with hypoplasia, initial eCAPs were mostly absent. In the first and last assessments, eCAP was recorded in 2 out of 7 and 2 out of 6 children with hypoplasia, respectively, and in 17 out of 17 matched peers with SNHL in both assessments. Compared to peers with SNHL, speech performance, the PROSPER scores, <sup>a</sup> was lower in both initial and the most recent assessments and did not improve over time.
Buchman 2011 (USA)	Retro	Inner ear malformation or CND with AD/C	76, 46% CND: 22, NR Non-CND: 54, NR	NR	72.0 (15.6-216)	Nucleus, AB	64/12	12-120	Intraoperative NRT	SRI-Q, ESP, PBK, CNC words	Open-set speech perception was achieved in 100% of children with IP-EVA, 50% of children with hypoplastic malformations, and 19% of children with CND. eCAP was absent in 61%, 33%, and 4%

											of children with CND, hypoplastic malformations, and IP-EVA, respectively. Robust eCAP recording was associated with higher speech perception scores. Non-verbal communication strategies were more common in children with hypoplastic malformations (69%) and CND (95%) compared to those with IP-EVA (18%).
Fulmer 2011 (USA)	Retro	ANSD with co-morbidities <sup>b</sup>  Matched SNHL	ANSD: 10, NR  SNHL: 10, NR	NR	ANSD: 44.4 SNHL: 58.8	Nucleus, AB, MedEl	ANSD: 8/2 SNHL: 6/4	ANSD: 43.2 SNHL: 51.6	Postoperative eCAP	SRT for mono-syllabic and spondee words	Children with ANSD and SNHL were not different in SRT and eCAP recovery rates.
Cosetti 2010 (USA)	Retro	SNHL	24, NR	5-17	Children: 7.5 years	Nucleus	NR	12	Intraoperative tNRT	Children: MLNT, PBK, LNT, GASP	No correlation between tNRT results and open-set speech performance.
Song 2010 (Korea)	Retro	CND, 9 with aplasia	13, NR	4.3 (1-13)	NR	Nucleus, AB	NR	26.5 (12-68)	Intra- and postoperative eCAP at 1, 3, 6, 12, 18, and 24	CAP, IT-MAIS	The average IAC was 1.78 mm (0.75-2.57 mm). Post-CI CAP scores ranged from 0 to 4. Only 2 children showed stable eCAP responses in post-CI assessments. No correlation was found between eCAP and CAP results.
Teagle 2010 (USA)	Retro	ANSD (9 with CND) with medical co-morbidities, 42% with prematurity	52, 19	7.3	47, 12-213	Nucleus, AB	2/50	41 (6-118)	Intraoperative eCAP	ESP, PBK, MLNT, LNT, IT-MAIS	50% demonstrated open-set speech perception abilities, and nearly 30% were unable to complete the test because of low CI experience or developmental delays. No child with CND achieved open-set speech perception abilities. In a subgroup of children with the results of eCAP and PBK tests, good open-set speech perception

											skills were associated with robust eCAP responses.
Guedes 2007 (Brazil)	Retro	NR	100, 53%	NR	NR	Nucleus	NR	6	Intra-operative NRT	Hearing capacity test, GASP	NRT response was recorded in 72% of children. Open-set sentence test scores were significantly better in children with present compared to absent NRT.

AB: advanced Bionics, AD/C: additional disabilities/comorbidities, ANSD: auditory neuropathy spectrum disorder, BKB: Bamford-Kowal-Bench sentence test, CAP: Categories of Auditory Performance, CDI: child development inventory, CI: cochlear implant, CL: comfortable level, CNC: consonant-nucleus-consonant, DEAP: diagnostic evaluation of articulation and phonology, DR: dynamic range, eCAP: electric compound action potential, ESP: early speech perception, EST: everyday sentence test, GASP: Glendonald Auditory Screening Procedure, IP-EVA: incomplete partition-enlarged vestibular aqueduct, IT-MAIS: Infant-Toddler Meaningful Auditory Integration Scale, LNT: lexical neighborhood test, MLNT: Multi-syllable Lexical Neighborhood Test, MWT: Mono-syllabic Word Test, NR: not reported, NRT: neural response telemetry, PBK: Phonetically Balanced Kindergarten, SIR: Speech Intelligibility Rating, SNHL: sensorineural hearing loss, SRI-Q: speech recognition index in quite, SP: speech perception, Pros: prospective, Retro: retrospective, SRT: speech recognition threshold, SWT: spondee word test, T: threshold, tNRT: predicted NRT, WIPI: Word Intelligibility by Picture Identification, WRS: word recognition score.

<sup>a</sup> The Pediatric Ranked Order Speech Perception (PROSPER) score allows for the comparison of speech and language outcomes across varying testing conditions, both between participants and within a single participant tested repeatedly over time. In PROSPER, tests are ranked according to their relative difficulty and quantified from 0 (least complex) to 34 (most complex) (Arjmandi et al., 2022; Valero et al., 2012).

<sup>b</sup> Including hyperbilirubinemia, family history, premature birth, hypoxia, perinatal infection, cystic fibrosis, Mondini malformation, attention deficit hyperactivity disorder (ADHD), autism