Cochlear Implant Outcomes in Children with Single-sided Deafness

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BACKGROUND

Research suggests that children with unilateral hearing loss (UHL) and single-sided deafness (SSD) exhibit deficits in spatial hearing and consequently have poorer speech comprehension in noise and localization abilities compared to their normal hearing peers. These children are more likely to repeat grades in school and experience poorer quality of life outcomes (Lieu et al., 2010). Current treatment options for UHL in children with aidable hearing include conventional hearing aids, bone-anchored hearing aids (BAHA), contralateral-routing-of-the-signal (CROS) hearing aids, FM-systems, and no intervention. For children with profound UHL there is currently no option that will provide sufficient amplification to the impaired ear because candidacy criteria for cochlear implantation in SSD do not yet include children; however, benefit with this intervention has been demonstrated in adults and in preliminary research in children.

RESEARCH QUESTION

In children with single-sided deafness (SSD), how do outcomes in those with cochlear implants compare to children with SSD receiving conventional interventions or no intervention?

METHODS

Databases Searched:
- PubMed, CINAHL, Scopus

Timeframe:
- January 2000 until January 2019

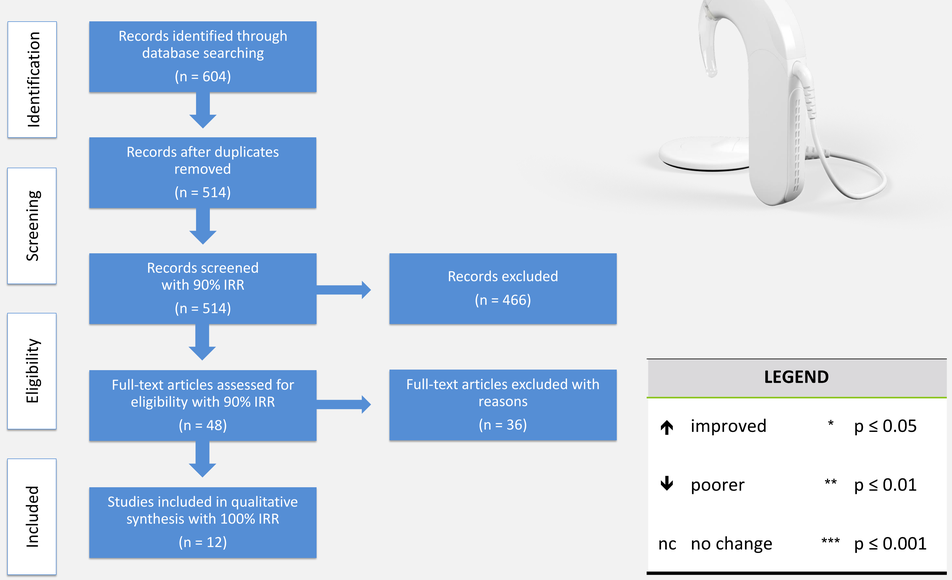
Key Search Terms included variations on:
(1) child, (2) single-sided deafness, and (3) cochlear implant
Full search terms available upon request.

Inclusion	Exclusion
Children (0-17 years)	Adults (18+ years)
Severe-to-profound sensorineural hearing loss in one ear with aidable hearings in the contralateral ear	Conductive hearing loss Bilateral severe-to-profound hearing loss
All etiologies, ethnicities, genders, socioeconomic status	Non-English articles
Experimental and non-experimental designs Between-subject and single-subject designs	Grey literature

Review Process Standards & Protocol:
- Independently conducted by the three authors
- ≥ 20% of articles double-reviewed at all levels of review
- Inter-rater reliability (IRR) calculated for each stage
- Quality appraisal(s) conducted on all articles eligible for inclusion in the final synthesis
- Data extraction completed on included studies

RESULTS

PRISMA DIAGRAM



LEGEND			
↑	improved	*	p ≤ 0.05
↓	poorer	**	p ≤ 0.01
nc	no change	***	p ≤ 0.001

Objective Measures

Reference	Sample (*n*)	Speech in Noise			Localization		Evidence Quality
		$S_0 \mid N_0$	$S_{SSD} \mid N_{NH}$	$S_{NH} \mid N_{SSD}$	0°	±90°	
Arndt et al. (2015)	9	↑	↑*		↑*		Good
Cañete et al. (2017)	1	nc	↓	↑	↑		Lesser
Hassepass et al. (2013)	2	↑*	↑*	nc	↑*		Lesser
Ramos Macías et al. (2016)	2	↑					Lesser
Sladen et al. (2017)	6	nc					Lesser
Távora-Vieira & Rajan (2015)	1	↑	↑	↑	↑		Lesser
Thomas et (2017)	14	↑***	↑**	↑*	nc	↑***	Good

Subjective Measures

Reference	Sample (*n*)	SSQ			Evidence Quality
		Speech	Spatial	Quality	
Arndt et al. (2015)	9	↑*	↑*	↑*	Good
Beck et al. (2017)	9	↑**	↑**	↑**	Lesser
Cañete et al. (2017)	1	↑	↑	↑	Lesser
Hassepass et (2013)	2	↑*	↑*	↑	Lesser
Ramos Macías et al. (2018)	34	↑***	↑***	↑***	Lesser
Thomas et al. (2017)	21	↑***	↑***	↑**	Good

CONCLUSIONS/LIMITATIONS

- Most studies report improvement in speech in noise and localization tasks following cochlear implantation
- Large, controlled studies are lacking on outcomes in children with SSD who undergo cochlear implantation
- Limitations:
  - Studies with comparator groups (other interventions) did not appear with the employed search strategy
  - Strategy excluded grey literature and non-English research articles
  - Heterogeneity in measures used across studies
  - Lack of reported mean values or statistical significance in studies
- The research question addressed could not be answered due to the lack of high-quality, controlled studies

FUTURE RESEARCH

- Conduct larger, controlled studies
- Include effect size in future data
- Replicate testing measures and protocols across studies to improve homogeneity
- Examine etiology and its role in outcomes
- Address expanded candidacy criteria for this population

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Images

1. [Cochlear Implant]. (n.d.). Retrieved February 10, 2019, from https://www.medel.com/us/news-room-us/. Copyright 2019 by MED-EL.

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