Effectiveness of multi-channel unilateral cochlear implants for profoundly deaf children: a systematic review


CRD summary
The authors found evidence of benefit in many aspects of unilateral cochlear implantation in children. The review was well conducted and the conclusions are likely to be reliable.

Authors’ objectives
To review the clinical and cost-effectiveness of unilateral multi-channel cochlear implants in comparison with non-technological support or with acoustic hearing aids for children with profound bilateral hearing loss.

Searching
Fourteen databases were searched from inception to July 2007, including MEDLINE, EMBASE, NHS EED, the Cochrane Database of Systematic Reviews, the Cochrane Central Register of Controlled Trials (CENTRAL), DARE, Current Controlled Trials, and NRR. Bibliographies and reference lists were also checked. Searches were restricted to articles in English, with the keywords listed in the report and a full strategy available on request from the authors.

Study selection
This study was part of a larger review of adults and children with severe to profound deafness (Bond, et al. 2009, see Other Publications of Related Interest). For the purposes of this study, the inclusion criteria were: studies of severely or profoundly deaf children comparing unilateral implanted devices with either non-technological support or acoustic hearing aids. Deafness was defined as the inability to detect tones below 70dB (severe) and 95dB (profound) in their better hearing ear. All systematic reviews and randomised controlled trials (RCTs) were eligible for inclusion as were other types of controlled study. The outcomes were: hearing thresholds, speech perception, speech production, adverse events, health-related quality of life, and education.

Studies of single-channel cochlear implants or those that used feature extraction coding strategies were excluded. The authors were contacted where the coding strategy was not detailed in the publication. Studies that compared cochlear implants with normal hearing controls or which had no control group were excluded.

No eligible systematic reviews or randomised trials were found. All studies included children who were profoundly deaf. Across the studies the children were assessed at a range of ages and a range of outcome measures were used. Follow-up varied from six months to 12 years.

Two reviewers were involved in the selection of studies for the review and disagreements were resolved by consensus.

Assessment of study quality
The internal validity of included studies was assessed using published guidelines and based on dimensions including confounding, study design (prospective or retrospective), blinding, and validity and reliability of outcome measures. External validity was judged according to the applicability of the findings to clinical practice.

Study validity was independently assessed by one reviewer and checked by another with disagreements resolved by consensus.

Data extraction
Data were independently extracted by one reviewer and checked by another with disagreements resolved by consensus.

Methods of synthesis
Studies were combined in a narrative synthesis using tables to show statistically significant outcomes of individual studies.

**Results of the review**

Fifteen studies were included (n=1,058 participants). Two were prospective cohort studies (n=340), three were cross-sectional (n=95), and ten had pre/post-prospective designs (n=623). Overall the studies were found to be of moderate-to-poor quality and were poorly reported. None had a power calculation to determine the sample size and few considered or explored the role of a range of potential moderating variables on the outcomes. Full details of quality were reported in the paper.

None of the included studies reported outcomes relating to quality of life, education, or adverse events.

**Unilateral implantation versus non-technological support** (six prospective pre/post studies, n=453): The studies had a variety of outcome measures, a range of methods of analysis, and limited reporting. They all reported gains (not always statistically significant) on all outcome measures, two with greater gains from earlier implantation.

**Unilateral implantation versus acoustic hearing aids** (nine studies, n=605): Overall the results showed that improvements on a variety of outcomes related to hearing, speech production, and speech perception could be made with cochlear implants.

**Cost information**

Five economic evaluations found paediatric unilateral implantation for deaf children to be cost-effective from a UK National Health Service perspective.

**Authors’ conclusions**

The research in this field showed benefits in many aspects of unilateral cochlear implantation in children.

**CRD commentary**

This review was underpinned by a clear research question with defined criteria for population, intervention, outcomes and study designs. Searching encompassed a range of electronic and other sources. Publications in languages other than English were not eligible, raising the possibility of language bias. Study validity was assessed appropriately. The methods of study selection, validity assessment, and data extraction minimised bias. A narrative synthesis was appropriate, given the heterogeneity of the included studies.

The review was well conducted and the conclusions are likely to be reliable.

**Implications of the review for practice and research**

**Practice:** Although there were some concerns about generalisability, the research indicated that unilateral cochlear implantation was likely to be an effective treatment for profoundly deaf children.

**Research:** Studies should be undertaken that include assessments of quality of life and educational outcomes in children with cochlear implants. These studies should have extended follow-up to determine the long-term impact of interventions on education and employment. Further research was needed to determine those factors that influence effectiveness, for example age at implantation, duration of deafness, and age of onset of deafness, but a RCT would not be ethically acceptable.

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This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.