

## **Critical Review: Do children with bilateral cochlear implants have better sound localization abilities than those children implanted unilaterally?**

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The aim of this critical review was to examine the literature regarding the effects of bilateral versus unilateral cochlear implantation on sound localization abilities in children aged 2 to 16 years. Overall, the findings suggest that bilateral cochlear implants offer some benefits for sound localization that are not achievable with unilateral implantations. Further research, using well-designed studies with a sufficient sample size is still needed to further quantify the benefits of bilateral cochlear implants for sound localization in this population.

### ***Introduction***

The advent of cochlear implants has drastically improved the management of severe to profound hearing loss in children. Recently, there has been an increasing interest in providing children with maximum hearing benefit through bilateral implantations (Litovsky, 2006a). This interest stems, in part, from studies on adults with bilateral cochlear implants that have demonstrated the benefits of binaural hearing (Van Hoesel, 2004).

To date, the majority of studies on bilateral cochlear implants have been performed on adults so very little is known about the benefits and/or risks of implanting a child with a second device (Litovsky, 2006a). The disparities between these populations make it difficult to generalize the benefits of bilateral implantations in adults to a pediatric population. For many adults, hearing loss is acquired later in life so prior acoustic stimulation has provided their auditory system with the stimulation required to develop binaural listening skills. Children on the other hand, have congenital or early onset hearing loss and often have little to no sound stimulation prior to implantation. This auditory deprivation can have compromising effects on the auditory system, affecting the child's ability to derive benefit from a cochlear implant. These differences, among others, make it necessary to directly assess the benefits provided to children from bilateral implantations.

Bilateral implantations can improve an individual's ability to hear in difficult listening situations by enhancing speech recognition and improving sound localization ability. When the same sound is heard from both ears, the listener becomes aware of speech and other sounds at a softer level, making communication easier. In noise, binaural hearing allows the auditory system to compare the signals being received by each ear in order to suppress the unwanted noise, making speech easier to understand.

Hearing with two ears also improves sound localization acuity, giving a listener the ability to locate speech and other important sounds in their environment.

The goal of this paper was to review the current literature on a pediatric population to determine whether bilateral cochlear implants provide improved localization acuity compared to unilateral cochlear implants.

### ***Objective***

The primary purpose of this paper was to critically evaluate the existing literature regarding the effects of bilateral versus unilateral cochlear implantation on sound localization abilities in children. Outcomes of the studies in this paper will allow for evidence-based recommendations to be made for future cochlear implant candidates.

### ***Methods***

#### ***Search Strategy:***

Computerized databases including MEDLINE, EMBASE, CINAHL, SCOPUS and PubMed were searched using the following search strategy:

((cochlear implant) AND (children) AND (sound localization)) AND ((bilateral) AND/OR (unilateral)).

Those studies not in the English language were excluded from the search.

#### ***Selection Criteria:***

Studies selected for inclusion in this critical review were required to investigate the effects of bilateral and unilateral cochlear implantation on sound localization abilities in a pediatric population.

#### ***Data Collection:***





Children: A Localization Acuity Measured with Minimum Audible Angle. *Ear & Hearing*. 27: 43-59.

Litovsky, R.Y., Johnstone, P.M. & Godar, S. (2006b). Benefits of bilateral cochlear implants and/or hearing aids in children. *International Journal of Audiology*. 45 (supplement 1): S78-S91.

Murphy, J., & O'Donoghue, G. (2007). Bilateral Cochlear Implantation: An Evidence-Based

Medicine Evaluation. *Laryngoscope* 117: 1412-1418.

Papsin, B.C., and Gordon K.A. (2007) Cochlear Implants for Severe to Profound Hearing Loss. *V357 (23)*: 2380-2387

Van Hoesel, R. J. M. (2004). Exploring the benefits of bilateral cochlear implants. *Audiology and Neuro-otology*, 9, 234-246