

# WITHIN-SUBJECT COMPARISON OF SPEECH PERCEPTION BENEFITS WITH A MULTIPLE-CHANNEL COCHLEAR IMPLANT AND A TACTILE DEVICE

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## INTRODUCTION

In order to adequately advise prospective cochlear implant patients and their families, a clinician must have a good knowledge of the potential for particular individuals to benefit from cochlear implants and other alternatives.

Multiple-channel cochlear implants and tactile devices provide alternative means for improving the speech perception of profoundly hearing-impaired people who receive little benefit from conventional hearing aids. Recent studies have shown that the majority of implanted profoundly hearing-impaired children receive significant speech perception benefits from the Nucleus Minisystem-22 cochlear implant.<sup>1</sup> However, the degree of benefit for individual children with cochlear implants varies over a wide range, with congenitally or

prelingually profoundly hearing-impaired children demonstrating poorer speech perception benefits.<sup>2</sup> Prelingually profoundly hearing-impaired children implanted at or after adolescence appear to have less potential for benefit with a multiple-channel implant than children implanted before they are 10 years of age.<sup>3</sup> Speech perception data from the Melbourne and Sydney cochlear implant clinics suggest that it is reasonable to expect that children implanted at an earlier age may develop an ability to perceive open-set speech through their implant alone without lipreading.<sup>4</sup> However, to date, prelingually hearing-impaired children implanted during adolescence have not generally achieved open-set speech perception with their implant alone without lipreading.<sup>5</sup> These results for congenitally deaf adolescents suggest that a cochlear implant is of primary benefit as a supplement to lipreading.<sup>1</sup>

## SUBJECT DETAILS FOR THREE CASE STUDIES

	Patient 114	Patient 144	Patient 165
Cause of deafness	Unknown	Rubella	Genetic
Age at onset	Congenital	Congenital	Congenital
Age at implantation	12 years	12 years	13 years
Communication mode	Total communication	Oral	Oral
No. of channels	22	18	22

For adults or children unable to benefit from a cochlear implant for medical or other reasons, tactile devices are a noninvasive means of providing additional speech information.<sup>6</sup> When used in combination with aided residual hearing and lipreading, tactile devices have been shown to provide cues to speech features that can be used to improve speech perception on both closed- and open-set word and sentence tests.<sup>7</sup> These benefits have been established for a wide range of patient groups, including postlingually and congenitally deaf adolescents, children, and adults.

Given that benefits for most congenitally deaf adolescents with multiple-channel cochlear implants are limited, tactile devices may provide a more viable alternative for prospective adolescent cochlear implant candidates than for younger children or adults. To establish whether in fact a tactile device may be a more suitable choice than a cochlear implant for some groups of children, the comparative performance of children with both devices should be studied.

## METHODS

This study assessed speech perception benefits for three congenitally profoundly deaf adolescents who used an electrotactile speech processor (Tickle Talker) and subsequently went on to use a Nucleus Minisystem-22 cochlear implant. Prior to the evaluations reported here, each child had received a similar habilitation program with both devices, conducted by the same clinician. Experience with the Tickle Talker prior to cochlear implantation varied from 10 months to 5 years. Experience with the cochlear implant was 1 year at the time of evaluation. Specific details for the three children are shown in the Table.

Speech perception benefits were measured with open-set Phonetically Balanced Kindergarten (PBK) words and Bam-

ford-Kowal-Bench (BKB) Sentences. Tests were administered live-voice, and a written response was required. Speech perception scores were analyzed with the binomial model and significance table developed by Thornton and Raffin.<sup>8</sup>

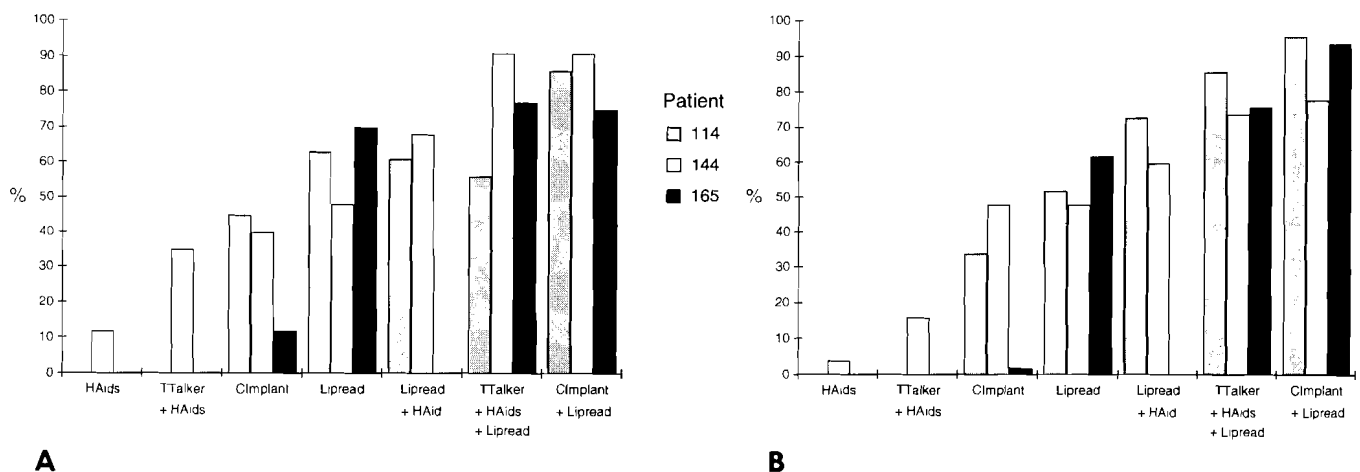
## RESULTS

The Figure shows speech perception test results for all patients. Both devices provided significant and comparable benefits for all children in the device-plus-lipreading condition. All children benefited from the additional information provided by either the Tickle Talker or the cochlear implant, and were able to perceive speech information with these devices that was not available through either aided residual hearing or lipreading. None of the three children were able to understand open-set words or sentences using either hearing aids alone or the Tickle Talker plus hearing aids, without the aid of lipreading. Two of the children showed significant ( $p < .05$ ) open-set speech perception benefits while using their cochlear implant alone.

## DISCUSSION

The results of this study show that it is possible for individual adolescents to achieve a significant degree of open-set speech perception using a cochlear implant, despite the low expectations the literature suggests for this patient group. However, no direct association can at present be demonstrated between preimplant use of the Tickle Talker and success with a cochlear implant. On the basis of the open-set speech perception benefits achieved in both this and other studies, the cochlear implant would be the preferred option for most potential candidates, including congenitally deaf adolescents.

The fact that the Tickle Talker and cochlear implant offer comparable benefit in terms of supplementation to lipreading confirms that the Tickle Talker is a viable alternative for people who cannot benefit from cochlear implantation for medical reasons (eg, middle ear problems, cochlear malformations, etc) or for those who do not wish to have surgery. The Tickle Talker could also be used in cochlear implant preoperative programs for evaluating the capabilities of potential implantees for processing speech information presented through a different sensory modality. It could also be



A

Speech perception test results. A) Phonetically Balanced Kindergarten Word test speech perception results for all three patients. B) Bamford-Kowal-Bench Sentence test speech perception results for all three patients.

B

used preoperatively with selected patients (particularly adolescents) to determine the level of commitment and motivation for using a speech-processing device.

Overall, congenitally deaf adolescents need to be considered on an individual basis with regard to prognosis for benefit from a cochlear implant and/or tactile devices.

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