

# COCHLEAR IMPLANT RESULTS IN PRELINGUAL ADULTS

**Ufuk Derinsu, Ph.D. / Ayça Ciprut, Ph.D. / Ferda Akdaş, Ph.D.**

*Sub-department of Audiology, Department of Otorhinolaryngology,  
School of Medicine, Marmara University, Istanbul, Turkey.*

## ABSTRACT

**Objective:** The purpose of this study was to assess the speech perception and speech understanding of the prelingually deafened cochlear implant users.

**Methods:** The study consisted of nine prelingually deafened adults implanted with Nucleus 24 M cochlear implant. Auditory performance was measured using a battery of closed and open set speech tests.

**Results:** Although no closed set and open set speech recognition was possible before implantation, a significant improvement over time was found at the closed set speech tests for all the patients. Three patients demonstrated some improvement of open set speech performance. All except one reported subjective benefits and satisfaction from the implantation.

**Conclusion:** Speech recognition evaluation is important but it is only one aspect in cochlear implant success criteria. In order to decide precisely about the benefits one can get from the implant, it may be useful to evaluate the patient in his/her daily activities, and his/her degree of incorporation in social life.

**Key Words :** Cochlear implant, Prelingual

## INTRODUCTION

Various research results demonstrated the benefits in speech recognition skills and open set

speech understanding in postlingually deafened cochlear implant users (1-3). On the other hand the prelingually deafened adults and adolescents who receive a cochlear implant benefit less from their implants (4-6).

Zwalon, Kileny and Telian (7) evaluated cochlear implant use and satisfaction by prelingually deafened adults. The patients evaluated, demonstrated little or no improvements in speech recognition 12 months postoperatively. But most of the patients used their implants regularly and they claimed that they were satisfied with their cochlear implant and that using the implant improved their communication skills.

Waltzman, Cohen and Shapiro (6) reported that the prelingually deafened cochlear implant users showed an increase in the awareness of environmental sounds and some improvements in the perceptual abilities but they did not obtain open set speech understanding after cochlear implantation.

Similar results were also obtained with prelingually deafened older children. The benefit that they gained from the cochlear implant use tended to be small like the prelingual adults using cochlear implant. Fryauf-Bertschy et al. (8) reported 34 prelingually deafened children implanted after 10 or more years of deafness. All of them use total communication as a means of communication. Although some of them had a greater emphasis on oral communication, others used sign language.

The purpose of this study was to evaluate the results obtained in the congenitally deafened and

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Correspondence to: Ufuk Derinsu, Ph.D., - Sub-department of Audiology, Department of Otorhinolaryngology,  
Marmara University Hospital, Altunizade, 81190 Istanbul, Turkey.  
e.mail address: uderinsu@hotmail.com

prelinguistic noncongenitally deafened cochlear implant users.

**MATERIALS AND METHODS**

Nine prelingually deafened adolescents and adults who had received cochlear implants at Marmara University Medical School participated in this study. Patients ranged in age from 17 to 39 years with a mean of 25.5 years. Table 1 shows the demographic information of each subject.

Of 9 patients , 2 were congenitally deafened with unknown etiology, 7 patients had hereditary hearing loss. There were 2 pairs of siblings in the study ,the patients numbered 3&5, and 6&7 in the Table 1, were siblings.

7 out of 9 patients used hearing aids prior to cochlear implantation.The patients were accepted to be appropriate candidates for cochlear implantation on the basis of medical, radiological and audiological evaluations. They had good general health and their temporal bone computerized tomography scans did not contraindicate placement of the electrode array. Audiologically, they were found to have profound hearing loss. Their speech detection thresholds with the hearing aids were 65dB or greater .

All patients were implanted with Nucleus CI24M cochlear implant device. The insertion of the whole electrode array was achieved in all patients. All patients used ESPrit behind the ear speech processor. All of them were programmed with SPEAK coding strategy. Length of cochlear implant use ranged from three to four years.

Mean preoperative hearing thresholds for right and left ear , preoperative aided thresholds in the

sound field and postoperative thresholds with the cochlear implant are shown in Fig. 1. The mean hearing thresholds in the free field with cochlear implant ranged from 30 to 45 dB HL, between 250 to 8000 Hz.

Communication Mode: Eight of 9 patients communicated orally. They were very good lipreaders. One of them used total communication. 7 patients' speech production was intelligible to the listeners who were experienced in understanding hearing-impaired speech. The speech intelligibility of the rest was intelligible to all.

Five patients were university graduates, 3 of them were normal high school graduates, 1 was in the third grade of the special class for hearing-handicapped children in a normal high school.

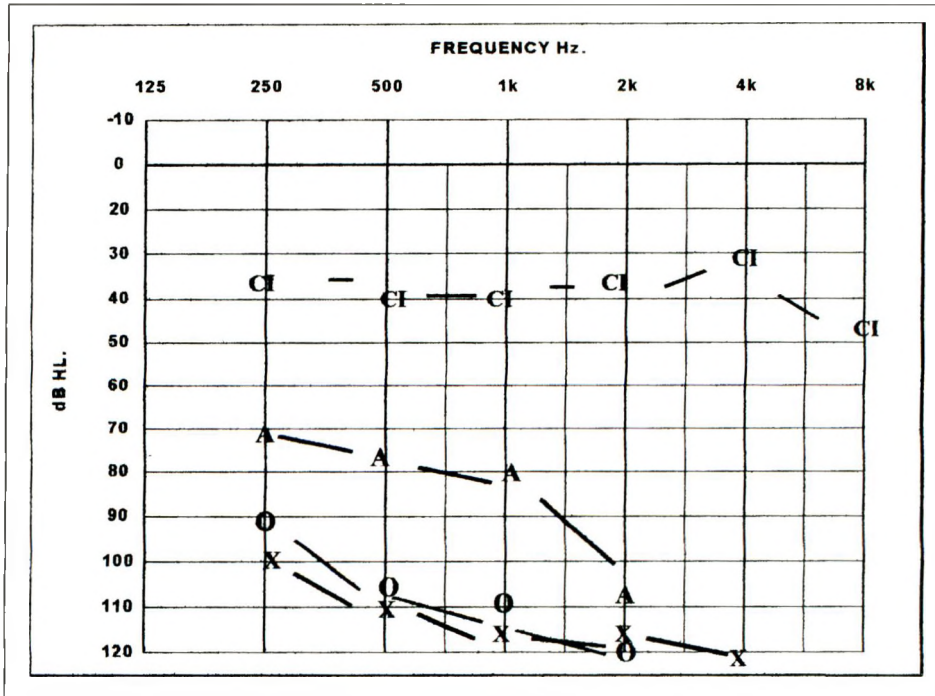
Auditory performance was measured using a battery of closed and open set speech tests. All tests were developed for the Turkish language, in the Audiology Department of Marmara University Medical School(9).

Open set word recognition was assessed using 3 syllable words, 2 syllable words and phonetically balanced monosyllabic words. Open set common sentence test was also administered. For the closed set testing, the identification of the phonemes at the beginning and at the end of monosyllabic words tests were used.

All tests were presented via live voice, at a distance of 1m with 0° azimuth and at 70 dB A. During the tests, the patients were asked to set their speech processors' sensitivity to the most comfortable level.

**Table 1:** Demographic information on the subjects

Subject	Age at Onset	Age of implant ( yrs )	Gender	Etiology	Duration of CI use ( yrs )
S1	Congenital	29	Male	Unknown	3
S2	Congenital	14	Male	Hereditary	3
S3	Congenital	36	Female	Hereditary	3
S4	Congenital	23	Female	Unknown	4
S5	Congenital	29	Female	Hereditary	4
S6	Congenital	18	Female	Hereditary	4
S7	Congenital	20	Male	Hereditary	4
S8	Congenital	31	Female	Unknown	4
S9	Congenital	22	Female	Unknown	4



**Fig. 1:** Mean preoperative hearing thresholds for right and left ear, preoperative aided thresholds in the sound field and postoperative thresholds with the cochlear implant. Mean preoperative hearing thresholds for the right and left ear are shown with O and X respectively. Aided thresholds in the sound field are marked with A. C indicates cochlear implanted thresholds in the sound field.

The data on cochlear implant patients were collected preoperatively and 6,12,24,48 months postoperatively. The time of follow-up for each patient was noted in Table I.

**RESULTS**

Preoperatively, none of the patients demonstrated open-set and closed-set speech understanding without lipreading. No response was obtained for all the speech tests administered for all patients. Table II and table III show the closed set and open set speech test results obtained at 6, 12, 24, 48 months postoperatively.

All patients demonstrated closed set word recognition after the implantation, the performance in closed set testing for most of the patients progressed overtime.

Only 3 patients out of nine were able to perform open set speech tests .

**DISCUSSION**

Cochlear implantation has been proven to be a method of choice for the habilitation and/or

**Table II:** Closed set speech test results obtained 6 months,1 year,2 years ,3 years and 4 years postoperatively. CS IP shows the closed set test for the identification of initial phoneme CS FP shows the closed set test for the identification of final phoneme

SUBJECT	CS IP %					CS FP %				
	6m.	1yr.	2yr.	3yr.	4yr.	6m.	1yr.	2yr.	3yr.	4yr.
S1	38	48	50	50	-	40	40	52	50	-
S2	18	26	26	32	-	36	32	36	36	-
S3	20	38	48	50	-	55	60	72	68	-
S4	22	46	46	52	50	32	68	64	68	68
S5	44	46	50	56	64	75	72	78	76	76
S6	0	16	34	38	34	0	28	46	44	52
S7	0	26	32	-	24	0	38	36	-	36
S8	42	56	76	72	80	45	64	84	80	84
S9	4	48	50	50	54	8	40	58	62	64

rehabilitation of the profoundly hearing-impaired. The prelingually deafened adult or adolescent cochlear implant users were found to benefit less from the cochlear implant. It is not straightforward to predict how much the prelingually deafened patient will benefit from the cochlear implant as



**Table III:** Closed set speech test results obtained 6 months,1 year,2 years ,3 years and 4 years postoperatively. OS 3S , OS 2S.OS MS and OS SENT show the open set 3 syllable word test, open set 2 syllable word test , open set monosyllabic word test and open set sentences test respectively.

SUBJECT	OS 3S %					OS 2S %					OS MS %					OS SENT %				
	6m.	1yr.	2yr.	3yr.	4yr.	6m.	1yr.	2yr.	3yr.	4yr.	6m.	1yr.	2yr.	3yr.	4yr.	6m.	1yr.	2yr.	3yr.	4yr.
S1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S4	40	84	84	80	84	40	56	52	52	56	0	12	8	12	12	20	62	62	68	68
S5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S8	42	64	84	88	84	24	36	38	46	50	0	16	24	32	36	20	40	68	72	68
S9	16	44	60	80	84	8	24	46	52	56	0	8	12	28	30	8	28	32	44	52

in the case of postlinguals because the number of patients is not large enough. There is little data available about the use and satisfaction from the cochlear implant by prelingually deafened adults.

In this study nine prelingually deafened patients' communication skills and speech recognition performance were investigated.

No closed set or open set speech recognition was possible for any of these nine patients. After the implantation all patients obtained significant scores on closed set tests. On the closed set speech recognition tests, all of them had dramatically good performances with varying degrees. The results were comparable to the results of the other prelingual adult patients (6,7).

Six patients were unable to perform the open set speech understanding tests. 3 patients showed significant improvement on open set speech tests overtime. These three patients were the ones who consistently used their hearing aids before implantation, they relied on acoustic information as well as lipreading for communication.

During informal interviews with the patients , one point was stressed by 8 of them; although they were not good at speech recognition, they were all satisfied with their implants. They all pointed out that, no matter what the test results were, their total communication showed a lot of improvement. All patients benefited from their implant especially in hearing the environmental

sounds that were previously not distinguishable, such as the door bell, foot steps coming from behind, telephone ringing, chirping of birds... Another informal observation was that there was a considerable increase in their self esteem, they become more confident; and that their participation in social activities increased. Only one patient was not happy with the cochlear implant, he was a non-user from the very beginning.

It can be inferred from the results of this study that, speech recognition evaluation is important but it is only one aspect in cochlear implant success criteria. In order to decide precisely about the benefits one can get from the implant, it may be useful to evaluate the patient in his daily activities , and his degree of incorporation in social life.

The positive subjective experience after the implantation and the improved mode of communication may not justify implantation for a large number of prelingual adults. Even if carefully selected, it remains important to adjust the expectations of prelingually deaf cochlear implant candidates to a realistic level.

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