

# THE SLOPE OF ELICTRICALLY EVOKED COMPOUND ACTION POTENTIAL AMPLITUDE GROWTH FUNCTION AND SPEECH PERCEPTION IN COCHLEAR IMPLANT PATIENTS

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## Introduction

The electrically evoked compound action potential (ECAP) represents a synchronized response generated by a group of electrically activated auditory nerve fiber. ECAP measures are advantageous because they can be measured using clinically available software, and can be used as an indirect estimate of spiral ganglion neuron (SGN) density in a subject, and then compared to speech recognition measures obtained within the same period of time during the life of the subject .In general, ECAP recordings provide information about the integrity of the electrode-nerve interaction. Studies show that for a constant inter phase gab (IPG) the slopes of AGFs are correlated with the number of surviving auditory neuron, generally speaking, steeper slopes are positively correlated with higher neural survival. ECAP thresholds can be used as rough estimates for initial loudness differences between electrodes during the first fitting, and improvement of ECAP thresholds after surgery show better synchronization in the auditory nerve.

## Aim of the work

The aim of this study was to determine the extent to which the slope of electrically evoked compound action potential amplitude growth function is correlated with speech perception performance in cochlear implant user .The final aim was to investigate whether the slope of the amplitude growth function of the ECAP can be used as a prognostic factor for good performance with CI.

## Subjects and Methods

Twenty prelingually deafened cochlear-implanted children were enrolled in this study implanted by either Medel or Advanced Bionics CI, with duration of CI use ranging from two to four years, all cases had normal cochlea and auditory nerve as indicated by preoperative CT and post- operative aided thresholds of 40 dB or better. The slope of ECAP were recorded in electrodes 1, 7 and 12 in patients with Med-EL implant and electrodes 1, 9 and 16 in patients with AB implant, representing apical, mid and basal electrodes respectively.

Performance in speech test (monosyllabic phonetically balanced kindergarten (PB-KG2) speech test, bisyllabic phonetically balanced kindergarten (PB-KG1) and word intelligibility by picture identification (WIPI) test ) were recorded and the 20 patients were classified according to their performance in to three groups:  
group 1 (good performers) with performance in monosyllabic phonetically balanced kindergarten (PB-KG2) speech test more 60%.  
group 2 (fair performers) with performance in monosyllabic phonetically balanced kindergarten (PB-KG2) speech test less than 60% but more than 60% in bisyllabic phonetically balanced kindergarten (PB-KG1).  
group3 (poor performers) including children with performance in bisyllabic phonetically balanced kindergarten (PB-KG1) speech test less than 60% and tested by WIPI speech test.

## Results

Table (1): Correlation between slope of ECAP and speech test % in the three groups.

Speech test %	N	Slope of ECAP					
		Apical E		Mid E		Basal E	
		r <sub>s</sub>	P	r <sub>s</sub>	p	r <sub>s</sub>	p
Group 1	6	0.239	0.648	-0.239	0.648	-0.359	0.485
Group 2	5	-0.718	0.172	-0.718	0.172	-0.410	0.493
Group 3	9	-0.235	0.542	-0.395	0.293	0.076	0.847

rs: Spearman coefficient

Table (2): Correlation between slope of ECAP and different parameters (n=20)

	Slope of ECAP					
	Apical E		Mid E		Basal E	
	r <sub>s</sub>	p	r <sub>s</sub>	p	r <sub>s</sub>	P
Threshold of ECAP	0.635*	0.003*	-0.024	0.920	-0.319	0.171
Age at implantation (years)	0.231	0.327	-0.181	0.444	0.132	0.579
Duration of CI use (years)	0.055	0.817	-0.014	0.952	0.124	0.602

rs: Spearman coefficient

\*: Statistically significant at p ≤ 0.05

## Conclusion

Our findings suggest that there is no relationship between the slope of the amplitude growth function of ECAP and speech perception in cochlear implant patients. So the slope of the amplitude growth function of the ECAP can not be used as a prognostic factor for good performance with cochlear implant.

Also, the correlation between slope of ECAP and thresholds was significant only in apical electrodes, but not significant in mid nor basal electrodes. In this study there was no significant correlation between slope of ECAP, age at implantation and duration of cochlear implant use.