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RESEARCH ARTICLE

Correlation between Behavioral and ART responses – Day of Switch on – Our Experience

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ABSTRACT:

Cochlear implant is an electronic device that restores hearing to severely and profound impaired adult and children by providing sense of sound for them. It secures the golden period of children's lifetime. Electrophysiological responses of cochlear implantees are measured by Electrical compound action potential (ECAP). It aids in programming for each individual through mapping. Electrical impulses which stimulate the functioning nerve cells in cochlea is processed in brain and exhibited as child's behavioral response during cochlear implant mapping. Eliciting conditioned responses is challenging during the first listening (on the day of switch on) especially for very young children, so observing behavioral responses is essential. It is a quite difficult process for mapping by ART alone, behavioral responses are also plays a crucial role. This study is to find the correlation between behavioral responses and Auditory nerve response telemetry (ART) responses, after 3-4 weeks from surgery on the day of switch on. A total of 22children who are congenitally impaired aged between 2 to 6 years were involved in this study. All of them were implanted with Medel Sonata, flex soft electrodes unilaterally. Post-operative ARTs for apical, mid and basal electrodes were recorded and corresponding behavioral responses were observed on the day of switch on.

Keywords: Cochlear implantee, Switch on, Auditory nerve response telemetry (ART), Behavioral response

INTRODUCTION

Cochlear implant isa device that provides direct electric stimulation to the auditory nerve in the inner ear. This device restores hearing to severely and profound impaired adult and children with cochlear hearing loss or where the cochlea is damaged. Because of this damage, sound cannot reach the auditory nerve. With a cochlear implant, the damaged hair cells are bypassed, and the auditory nerve is stimulated directly.[1,3]

It provides sense of sound for the hearing impaired; mostly children to secure their golden period of lifetime.[2] Because critical age is the timeline where the child has to learn their basic necessity to communicate.[4]

Electrophysiological responses of cochlear implantees are measured by the presence or threshold of electrical compound action potential (ECAP). The ECAP evoked and measured by the implant is from the distal part of the auditory nerve and hence corresponds to the peak I of the ABR. It is measured as a near field potential/response by

implant. One of the electrodes delivers the electrical stimulus (current/change) and another electrode picks up the response. The electrodes that will stimulate and pick up the response are selected the audiologist through respective software. Measurement of the ECAP is difficult because the potential to be measured is in microvolts while the electrical artifact due to the implant is extremely high.

Post operatively, ECAP measures aids in programming for each individual through mapping.An electrical impulse which stimulates functioning nerve cells in cochlea is processed in brain via the classical auditory pathway and is exhibited as the child's behavioral response during mapping procedures.[5,6] Eliciting conditioned responses is challenging during the first listening (on the day of switch on) especially for very young children with cochlear hearing loss or where the cochlea is damaged. Hence observing behavioral responses is essential. It is quite a difficult process for mapping by ART measurements alone, making a note on behavioral responses is also crucial.

METHODOLOGY

A total of 22 children, congenitally impaired (12 male and 10 female) aged between 2 to 6 years (mean-3.75, standard deviation-2.49) were involved in this study.All of these children were operated with cochlear implant device Medel Sonata TI 100, flex soft electrodes unilaterally. After 3-4 weeks from surgery, cochlear implant mapping and switch on is done for the children.On the day of switch on; while mapping, ART responses were recorded for apical, mid and basal electrodes respectively.Behavioral responses were observed during ART recording and also during mapping procedure to set appropriate current levels for individual electrodes. These behavioral responses were classified as consistent, inconsistent and absent.

RESULTS AND DISCUSSION

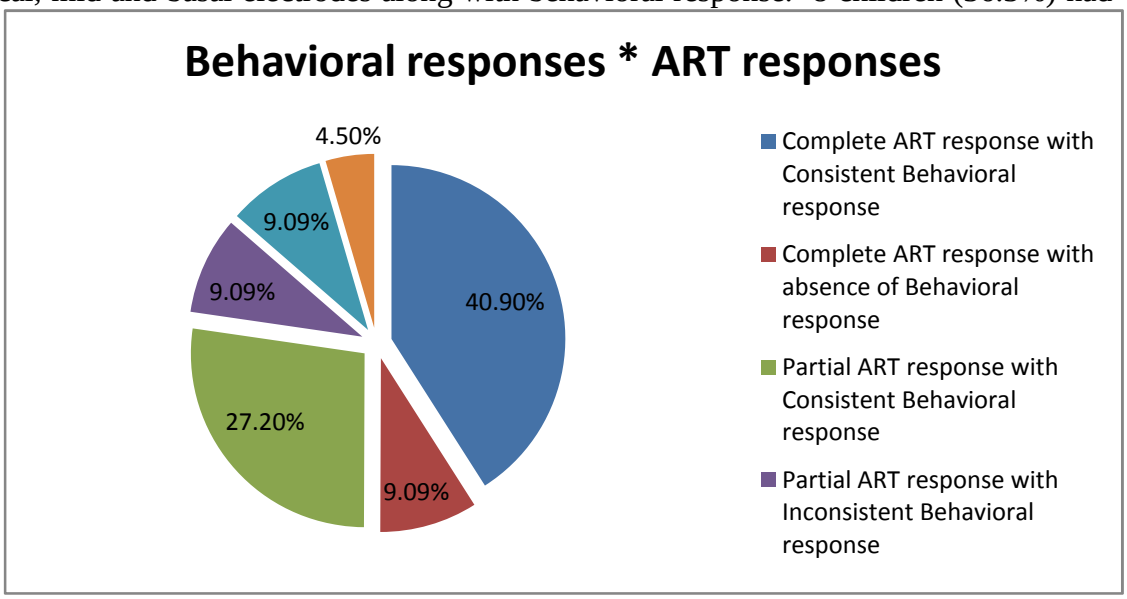
The relation between ART and Behavioral responses were analyzed.

Behavioral responses		ART			Total
		Complete	Partial	Absent	
	Consistent	9	6	2	17
	Inconsistent	0	2	1	2
	Absent	2	0	0	3
Total		11	8	3	22

Among22 children, complete ART responses at apical, mid and basal electrodes along with consistentbehavioral responses (crying, head turn, smiling, searching) were observed in 9 children (40.9%), and no behavioral responses were observed in 2 children (9.09%); Partial ART response either at apical, mid or basal electrodes along with consistent behavioral responses(crying, head turn, smiling, searching) were observed in 6 children (27.2%). Out of these 6 children, mid and basal electrodeART responses were observed in 4 children (18.1%); basal electrode ART response were observed in 2children (9.09%). Partial ART response either at apical, mid or basal electrodes along with inconsistent behavioral responses were observed in 2 children (9.09%); out of these 2 children, apical

electrode ART response was observed in 1 child (4.5%) and basal electrode ART response was observed in 1 child (4.5%). In 3 children (13.6%), ART responses were absent in all apical, mid and basal electrodes along with consistent behavioral response(crying, head turn, smiling, searching).

Through these findings, we infer that 11 children (50%) have shown ART responses in all apical, mid and basal electrodes along with behavioral response. 8 children (36.3%) had



either apical or mid or basal electrode responses along with behavioral responses. 3 children (13.6%) exhibited behavioral responses even in the absence of ART.

The data (ART responses and Behavioral responses) from this study was statistically analysed through chi-square test

Chi-Square Tests			
	Value	**df**	**Asymp. Sig. (2-sided)**
Pearson Chi-Square	4.539[a]	4	.338
Likelihood Ratio	5.477	4	.242
N of Valid Cases	22		

The test results reveal no significant correlation between ARTs and behavioral responses.

CONCLUSION:

The presence of ARTs doesnot always exhibit coexisting behavioral responses and vice versa. This makes post operative cochlear implant mapping really challenging especially for very young cochlear implantees. Thus we conclude that apart from considering ART responses; observing behavioral responses is essential for cochlear implant mapping, to assign appropriate current levels for each individual electrode to ensure the best possible speech perceptual outcomes in children.

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