

ESRT, ART and MCL correlations in experienced paediatric cochlear implant users

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Introduction

A crucial part of cochlear implant fitting is adjusting the stimulation levels to the patient's dynamic range. Assessment of Most Comfortable Levels can be a problem, in young, non-cooperating children. Fortunately there are objective tools like eESRT (electrically Evoked Stapedius Response Threshold), eEABR (electrically Evoked Auditory Brainstem Response), eECAP (electrically Evoked Compound Action Potential) that help to establish stimulation parameters. (Hughes 2000)

Many studies show that there is a strong correlation between eESRT and behavioral Most Comfortable Levels on each electrode in adult patients. (Jerger 1986)

The goal of this study was: to compare the objective measurement results in children and adults and to find objective method that could be used for fitting children, to estimate how the objective response thresholds differ depending on electrode position – in basal, medial and especially in the apical region of cochlea, and finally, to assess the viability of using eSRT and eCAP thresholds to create speech processor programs in children with the Med-El Opus II speech processor.

Methods and Material

Thirty patients, implanted with a Med-El Pulsar system with an Opus II speech processor, participated in the study. For the adult group, 15 postlingually deafened, experienced implant users were chosen. The subjects' ages during study ranged from 18 to 66, (mean 45 years), years of implant use ranged from 2 to 25,(mean 13 months).

For the paediatric group, 15 implant users were chosen, aged from 1y 8mo to 8y 6mo, (mean 5 years), implant use: from 6 to 36months, (mean 17 months)

Full insertion was achieved without surgical complications in all patients.

For all patients eSRT and eCAP were measured.

Electrically Evoked Stapedius Response Threshold was checked and recorded, using a middle ear analyzer Madsen Zodiac on each active electrode. As the recording system of the analyzer

is very sensitive to movements and no anaesthesia was used, in the group of children limited (passive) cooperation had to be obtained.

Electrically Evoked Compound Action Potentials were measured on electrode 2 (apical), 6 (medial) and 11 (basal) using dedicated software “ART Research”, which shows more flexibility in parameter setting than the algorithm commonly used in CI fitting software. ECAP threshold was calculated using linear approximation.

Additionally Most Comfortable Loudness Level (MCL) was measured in the adult group. Subjective judgment of MCL for each active electrode was performed using a loudness scaling procedure beginning at “very soft” through “soft”, medium, loud but comfortable and very loud, ending at “uncomfortably loud”. For further analysis MCL was defined as a correct level eliciting hearing sensation at “loud, but comfortable” levels.

Results

In Figure 1, the mean values of Electrically Evoked Stapedius Response Thresholds, (ESRT) Compound Action Potentials Thresholds (named Auditory Nerve Response Telemetry in Med-El systems) and Most Comfortable Loudness Levels for adults patients measured for electrode 2, 6 and 11 are shown. For each electrode mean values of MCL are closer to ESRT than to ECAP thresholds.

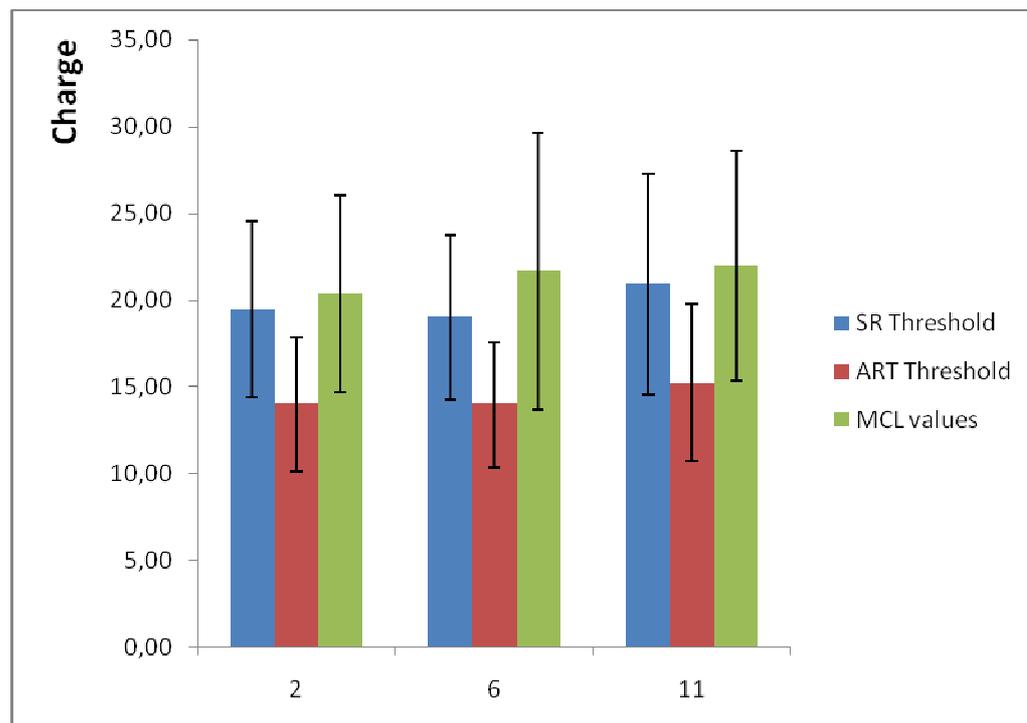


Figure 1. Adults: mean values of eSRT eCAP and MCL for electrode 2, 6 and 11

The mean correlation coefficient between MCL and ESRT levels is significantly higher (0,75) than that between MCL levels and the ECAP threshold (0,39). Both correlations are significant. (Fig. 2)

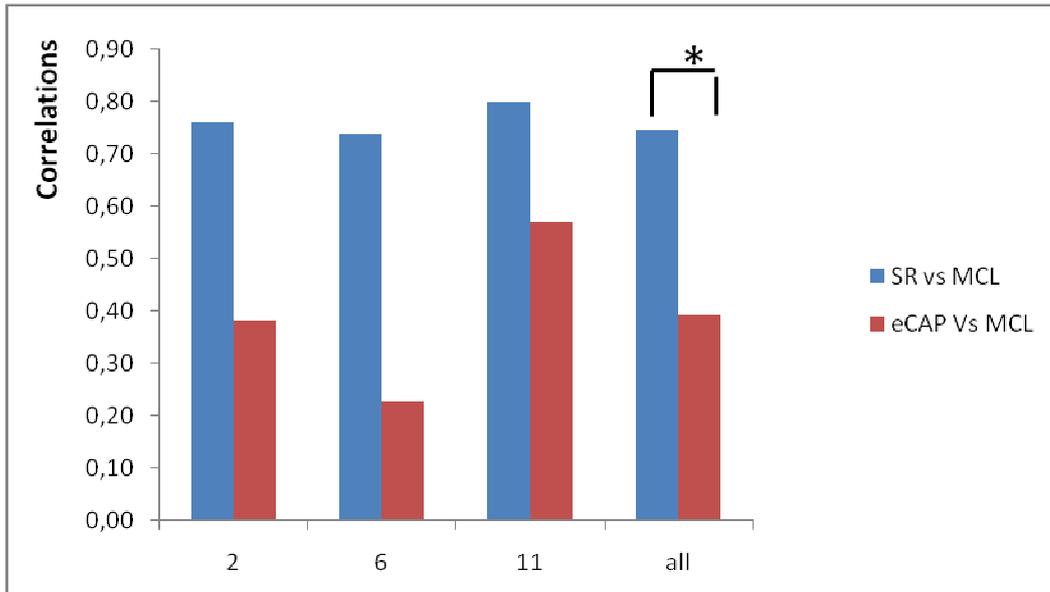


Figure 2. eSRT vs MCL and eCAP vs MCL correlations for adults

Additionally, there is no significant difference in mean values of eCAP and eSRT obtained for children and adults for apical (11), medial (6) or basal (2) electrode (Figure 3)

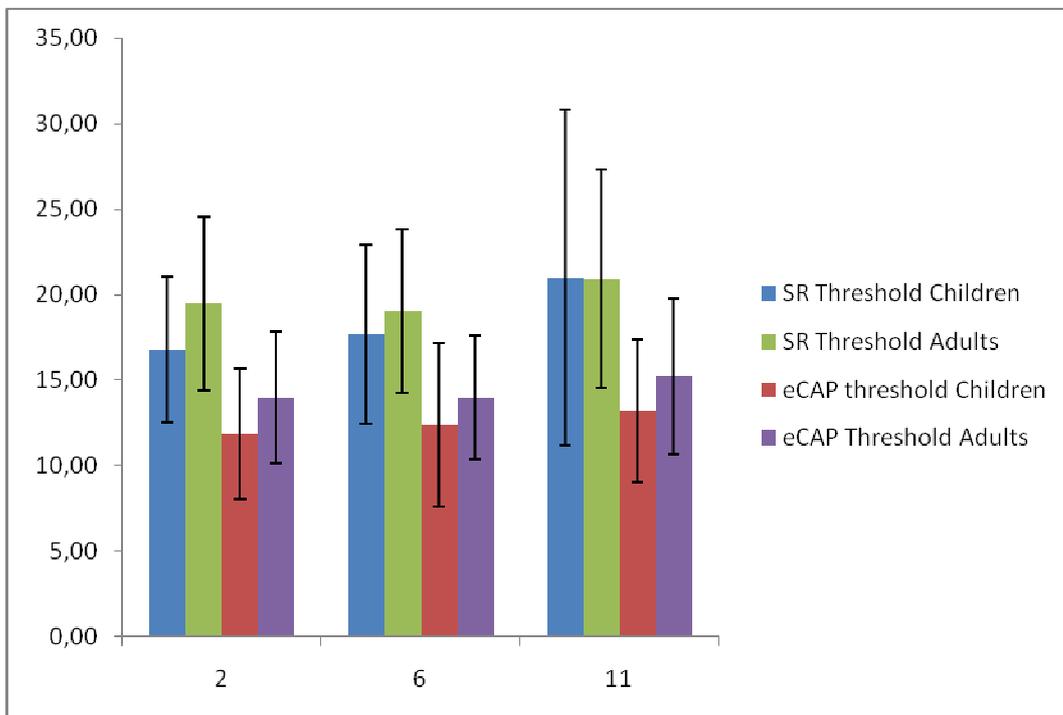


Figure 3. Children vs Adults: mean values of eSRT and eCAP (charge units) for electrode 2, 6 and 11

Conclusions

Although there are many objective as well as subjective tools for estimating fitting parameters, stapedial reflex thresholds (SRT's) seems to be one of the most useful tools for most comfortable loudness (MCL) prediction for adults.

As there are no significant differences of mean values of eSRT for adults and children, eSRT could be considered as a MCL predictor for children.

From the results, the ECAP threshold could be considered as a useful tool to assist with map creation for children in cases when eSRT fails due to technical reasons.

References

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