Minimizing the risk of the overstimulation in children after cochlear implantation

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INTRODUCTION

• The most important stage in a speech processor fitting is the identification and setting the proper parameters of electric stimulation to achieve the highest possible speech understanding.

• This could be done by subjective (psychoacoustic) or objective (electrophysiologic) measurements.
INTRODUCTION

Objective measurement in CI fitting:

- EECAP
- ESRT
- EABR
- Cortical responses


INTRODUCTION

During each fitting combination of objective and subjective measurements are utilized to obtain optimal parameters, but it is still a challenge in case of children.
INTRODUCTION

During fitting of a children our aim is to develop perception ability by giving access to sounds, but during this proces...

... still there is a risk of overstimulation
The aim of the study was to determine if children undergoing routine fitting could be affected by overstimulation confirmed by objective examination as well as parents questionnaire.
MATERIAL AND METHOD

• 27 children implanted with Cochlear (14 patients) and Med-El (13 patients) systems participated in the study
• Unilateral implantations – no loudness summation
• Aged from 7 months to 9 years (mean age: 3.7 years)
• Measurement results collected during standard visit 9 months after first fitting
MATERIAL AND METHOD

• Stapedius Reflex Threshold (SR Threshold) elicited by acoustic stimuli
  – Data collection – Interacoustics TITAN, decay mode
  – Stimulation – WESTRA system, narrow band noise, frequency: 500Hz, 1000Hz, 2000Hz and 4000Hz, intensity from 40 to 90dB HL
MATERIAL AND METHOD

• Routine subjective assessment of overstimulation: questionnaire on loudness perception designed in our clinic and distributed among children’s parents
  – Questions about different situations like switching the processor on, changing programs, noisy and school situations etc
  – Parents assessed how often (according their opinion) possible overstimulation happened in situation mentioned above in the scale as below:
    never – rarely – from time to time – often - always
Percentage of „too loud” responses – mean values for each patient: no „always” nor „often too loud” responses, the rest of response below:

- never, 70%
- from time to time, 12%
- rarely, 18%
RESULTS

SR Threshold (mean) vs QR mean
QR results from 0% (never too loud) to 100% (always too loud)

$R^2 = 0.04919$

SR Threshold (lowest) vs QR max

$R^2 = 0.04779$
RESULTS – SR Threshold

SR Threshold: **red flag** when Mean SR Threshold equal or lower than 70dB HL

- **group (SR+) - 3 of 27 children**

„normal (safe) value“ – Mean SR Threshold greater than 70dB HL

- **group (SR-) - 24 of 27 children**
RESULTS

Comparison of "TOO LOUD" answers for (SR+) and (SR-) groups

<table>
<thead>
<tr>
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<th>(SR+)</th>
<th>(SR-)</th>
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<tbody>
<tr>
<td>Never</td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td>Rarely</td>
<td>20%</td>
<td></td>
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<tr>
<td>From time to time</td>
<td>33%</td>
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5% of SR+ responded "Never" to "TOO LOUD".
20% of SR+ responded "Rarely" to "TOO LOUD".
33% of SR+ responded "From time to time" to "TOO LOUD".
RESULTS

Percentage of SR-

never | rarely | from time to time

0% | 0% | 35%
CONCLUSIONS

1. Preliminary results show that finding SR Threshold lower or equal to 70dB HL could indicate potential risk of overstimulation during CI use.

2. By adding new objective and subjective tests to the standard test battery it is possible to identify children suspected of overstimulation. Additionally it seems that parents sometimes are too conservative while describing children hearing sensations and obviously it should not be recommended to rely only on their opinions in program loudness assessing.