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Opinion

Practical implementation of the SWEEP-session of Stimulation-Registration in CI fitting

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Abstract

Levels of electrically evoked stapedial reflex thresholds (eESRTs) are frequently used as most comfortable levels (MCL) in cochlear implant fitting. The problem of routine one-channel-technique of reflexometry is long duration of this procedure. In order to "compress the time" we suggest method of consecutive stimulation of all electrodes of implant with simultaneous registration of stapedial reflexes-SWEEP-session. Practical implementation of the SWEEP-session is described here. This method has been successfully used in several hundred CI patients. Registration of evoked electrical stapedial reflex thresholds (eESRTs) during CI fitting is long procedure. In order to "compress the time" we suggest our SWEEP-session method. Practical implementation of this SWEEP-session is described here in accordance with the patent of Russian Federation.

Beginning

What have we in the beginning of the registration of the stapedial reflexes? Here are the most common state of affairs.

1. Parents identified that some, for example, the third program is used by the child. Let it be Map 29. Then 4-th program is Map 30.

2. We know intraoperative levels of eESRT. Previously, we showed that MCLs of optimal program (now Map 29) can be close or even exceed these levels of eESRT [1,2].

3. The child knows SWEEP-stimulation as we used it during the fitting when we were increasing levels of the programs from day to day. We believe that the SWEEP-stimulation was even interesting for a child because he heard sounds of different spectrum from buzz to beep because subjects perceive frequency in accordance with the place theory [3].

4. In the beginning of the fitting we set the parameters of the stimuli that were used during fitting. The duration of the stimuli is 300 ms, the intervals between them are 600 ms, this interstimulus interval 600 ms was used as we found previously that preceding stimulus has no effect on the reflex of next stimulus. These parameters we shall use in SWEEP-session of stimulation-registration.

Preparation for SWEEP-session

We connect speech processor to the interface box DIB. The fitting antenna is placed on the child's head. We open optimal at this moment program - Map 29, and perform telemetry. Save data. We select all channels and reduce all MCLs to 5 step by click Page Down. One step is press of a button "arrow down" or "arrow up". We show the child that he will listen the sequence of signals now and perform a SWEEP stimulaton. The

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child does not mind - we are friends already. We switch on impedancemeter AT235. We show the child by gestures that we are now going to blow in and draw out the air from his ear. We enter the obturator probe in the external auditory meatus of the contralateral ear of child. If there are problems we use mother's ear for demonstration of safety of this insertion. Perform tympanometry. Switch impedancemeter in Decay test mode. Everything is ready.

Implementation of SWEEP-session

We show to the child that sequential stimulation will be now. You can increase C-levels 1-2 steps up. Simultaneously we run the Decay test and the SWEEP stimulation. We observe the child and the screen of impedancemeter. It is likely that we will not see anything except results of the possible movement of the child. "Ask" the child: "How are you?" Further we show that we'll slightly increase the volume of signals. We increase all C-levels at 3 steps up and repeat the SWEEP-session. Let we had seen the stapedial reflexes in some channels during this session. If some of them are clearly above threshold, we reduce the MCLs in these channels 1-2 step down- depending on the amplitude of the stapedial reflex. In those channels where the stapedial reflexes are of threshold levels we do not change the C-levels. In those channels where the stapedial reflexes are absent we increase the C-levels at 2 steps up. Again we show to the child that now the sequential stimulation will be. Some of the children nod. We perform SWEEP-session and we correct C-levels in the same manner: decrease-no change - increase. After one or two the next SWEEP-sessions, we'll get the threshold levels of reflexes in all channels. In order to check result we reduce all C-levels in all channels down 2 steps and perform SWEEP session. There are no the stapedial reflexes. We remove obturator probe from the external auditory meatus of child. Further we increase the C-levels up 2 steps and save this program - automatically number Map 31. Upon such verification we can be sure that C-levels of Map 31 are 1-2 step higher than levels of eESRTs. Satisfactory result.

After this successful and quick registration of stapedial reflexes I quote words of Russian writer A.S.Pushkin: "Ai da Pushkin. Ai da sukin sin". It should be noted that our SWEEP-session is carried out in all patients almost without problems. Only in very rare cases it is necessary to perform reflexometry under anesthesia. But there is a significant plus in this case - reduced duration of the anesthesia.

Creation of configuration

Further for creation of configuration (four maps) we do so. We increase and decrease the level by one step in any channel of Map 31and save map under Map 32. Further we rename Map 32 in the map31pl1-2-62-21. How to understand this? This name means that the Map 31 is a program with C-levels of 1-2 step (pl(us) 1-2) above the levels of the eESRTs. The tympanogram, at which threshold reflexes were obtained, has the following characteristics: compliance 0.62 ml at a pressure -21 daPa. Why do we recommend such operation?.

As it is known, the stapedial reflex is recorded at equal gas pressure in middle ear and external auditory meatus and therefore tension of embroiled BM at only due to negative pressure in the middle ear does not affect the amplitude of stapedial reflexes. However compliance of eardrum may be different at one and the same person at different times due to different reasons (inflammation, for example). Naturally, thresholds of the stapedial reflex will be higher than normal ones if compliance of eardrum is lower than normal one. Therefore, we keep the parameters of the tympanogram during this measure. We can get stapedial reflex some months later but with another tympanogram and we can compare both results and to clarify the actual reflex thresholds. Manifestation of stapedial reflex depends on compliance of eadrum so it is necessary to consider this fact when you prepare the configuration.

Let tympanogram is good one. In this case, when the prescribed level of processor activation is 95% this Map31 can be written as a second program. A lower level of activation is wrong one, because it can lead to an unjustified decrease of the discharge rate in all channels, and if you use the strategy FS-4, there will be a decrease of the number of channels in which it operates. First program Map32 is 3 steps lower than Map 31, third program Map 33 and forth program Map 34 are 3 and 6 steps higher than Map 31 accordingly. Parents have to choose the optimal program. N.B. If the amplitude of tympanogram is below normal value, you should write the Map 31 as third program in the configuration. As it is known the threshold levels of the reflex is not always C-levels of optimal program [4.5]. So we have to complete the fitting.

Completion of the fitting briefly

Briefly about the completion of the fitting. Use of real sources of sound with wide spectra with irregularities of amplitudes and unknown SPLs will not help us. We use special stepped noise sounds for search of C-levels for the optimal program. Using our new method for fitting we can find C-levels in low, middle and high frequency ranges of spectrum separately (SHCHUP) [6]). This method is suitable for fitting of small prelingual children and can be modified for any type of implant.

For selection of comfortable program we give instruction-explanation to the CI-parents and CI-patients. Here is excerpt from our "Instruction" [7]. "During our life we all use always the same program. Sometimes we hear loud sounds. But we do not always use earplugs. Why cannot your CI-child hear loud sounds? Sometimes. Can. And must!!! Sometimes!!! Program is optimal one if your child sometimes hears loud sounds".

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