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Perspective

The Second and Subsequent Sessions of the Med-El Cochlear Implant Fitting

Petrov SM*

Research Institute of the Ear, Throat, Nose, and Speech, St Petersburg, Russia

***Corresponding author:** Petrov SM, Research Institute of the Ear, Throat, Nose, and Speech, St Petersburg, Russia

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In the previous article [1], we briefly described the procedure for the first switch on and the first session of fitting of the Med-El cochlear implant. After the first session, the patient has 4 programs in the speech processor with increasing comfortable levels (C-levels) in the sequential MAPs. C-levels – comfortable levels - are the maximum current levels recorded in any channel of any program. The C-levels of the second program are based on the results obtained by the program SHCHUP [2,3]. The C-levels of the first program are three steps (step - 0.2-0.3 dB) lower than the second which in most cases are comparable to threshold levels of the stapedial reflex. Sometimes they can be higher. There is the explanation of this difference [4]. In the third and the fourth programs, the C-levels are simultaneously increased in all channels relative to the C-levels of the second program by 3 and 6 steps, respectively. The optimal (working, everyday) program is determined by parents in accordance with our explanation-instruction [5], by watching the behavior of the child on different programs in different sound environments. In this optimal program, C-levels are called Most Comfortable Loudness (MCL) levels. The child uses the program with MCL levels constantly, with the exception of places with a very loud environment (cinema, concert, performance, etc.), where he can switch to the program with C-levels lower than MCL levels. This article describes a work of an audiologist during the second and subsequent sessions of the CI fitting. Most of the articles in the bibliography were written specifically for the future "Guidelines for the cochlear implant fitting". Links to the world literature are in the references to the above-mentioned articles.

Procedure

When parents come with a child to an audiologist, they may have the following discussion:

"How are you?" we ask parents about the results.

"Everything is fine." mom replies.

"What is the optimal program?" we question. "How did you choose it?"

"We use the third."

"And what about the second?" we ask.

"Child asks "What? Huh?" and asks to do better."

"And the fourth?"

"Tried it, I don't like it"

"Wonderful."

We talk with the child, to evaluate the work program in a live voice, sometimes slightly increasing the loudness of the conversation. N.B. MCL levels in the working program are higher than the threshold C-levels of the stapedial reflex. We connect the processor to the DIB, place the antenna for fitting on the child's head. "Is everything all right?" We carry out telemetry, save it. The next step is to open the work program selected by the parents (in our case MAP3), write the results of the new telemetry into it, and save this program. Let us assume that its number is 21. We increase and decrease the C-level by one step in any channel and save this program with the name Work21 for future use and comparison.

We open a program with the results of recording a threshold C-levels of the stapedial reflex. It was saved with the results of tympanometry in the first fitting session [6]. We write the results of the last telemetry into it and save this program at number 22. Later we will call it the reflex program. We compare C-levels of work program 21 and reflex program 22, so that in the further setup procedure we'll monitor the approach of the C-levels of our test program to the C-levels of reflex program 22. We need to know this approach when we conduct categorical loudness scaling (CLS) [7] during the fitting. C-levels of electrical stimuli at which threshold

stapedial reflexes are recorded have a loudness rating in the GOOD-LOUD range.

Parameters of Stimuli and Method of Stimulation

The duration of the electrical test stimuli is 300ms. In this work, we use stimulation with single pulses and stimulation of separate channels in SWEEP mode with an interval between sequential stimuli of 300 ms, as well as sequential stimulation of all channels in SWEEP mode with an interval between stimuli of 600 ms. Such an interval is used during registration of a stapedial reflex. The amplitude of stimuli is equal to the C-levels set in each channel. An amplifier, headphones, and stepped noises for conducting SHCHUP [2,3] are ready.

Fitting

We open the working (everyday) program 21. In the further fitting process, we will change the C-levels in this program and hereinafter we will call it a test program. We reduce the MCL levels of program 21 by 2 page down (according to C-levels, it will be less than reflex program 22). We remind (we show with gestures) to the child that when we will press the keys of the keyboard, he will hear either a single signal or their sequence. We demonstrate the child a single and SWEEP stimulation through separate channels. We give a single stimulus to the middle electrode with the number 5-7, where the patient hears the middle frequencies. We observe the child and ask: "How? Heard?" The child responds. It is very possible that he will agree. If everything is normal, then we apply single stimuli to other electrodes. "Is everything all right?" We apply stimulus sequences (SWEEP) to single electrodes. "Is everything all right?" We set the interval of 600ms and apply the SWEEP stimuli sequentially across all channels. We will sometimes use sequential SWEEP stimulation of all channels with an interval of 600ms - it is interesting for the child. We remind the meaning of the pictures used in categorical loudness scaling (CLS) [7] and ask the child to show how he hears? The child shows. We ask: "Can I increase loudness?" Child agree: "You can." We increase by 3 steps and give single and SWEEP stimuli through separate channels. "Is everything all right?" By agreement with the child, we continue the parallel increase in the C-levels of the test program, conducting single and SWEEP stimulation on separate channels. We carefully monitor the reaction of the child. We ask to show the loudness in the pictures. When approaching the MCL levels of the old work program 21, we save the test program under No. 23.

Registration of Threshold Levels of The Stapedial Reflex

Next, we proceed to the measurement of threshold levels of the stapedial reflex in accordance with the previously described procedure [6]. We set the interval between stimuli to 600 ms. We equip the child for registration of the reflex and perform tympanometry. We open the reflex program 22 and reduce the C-levels in all channels by 3 steps. We provide SWEEP stimulation with interstimulus interval of 600ms across all channels. "Is everything okay?" Starting from these C-levels, we define the C-levels where the threshold values of the stapedial reflex are marked and save the program with these threshold C-levels under the number 24. Under the number 24CCPP, we save the reflex-program with the parameters of the tympanogram; CC-compliance, PP-pressure at the point of max compliance [6]. For the history. We dismantle the registration unit, release, and praise the child. We compare the last results of registration of threshold levels of reflex and tympanometry with similar results obtained during the first fitting session. As a rule, the threshold levels of the reflex differ only slightly by 1-2 steps in some channels. Within the margin of error. The results of an old and new tympanometry are also quite close. The child safely tolerates the procedure of reflexometry as MCL levels of test program 23 are higher than the C-levels of the old reflex program 22. Very careful measurement of threshold levels of reflex (up to one step) is not required because the final profiles of MAPs are based on the result of the SHCHUP [2,3]. Now it is enough to make sure that the results of the current registration and the results obtained during the first (or previous) fitting session are close.

Categorical Loudness Scaling – CLS [7]

We open the test program 23. We again remind the meaning of the pictures used in the CLS [7]. Previously, the child has already shown his ability to evaluate the loudness. We conduct CLS in full. We present electrical stimuli in the SWEEP mode on a single channel with an interval between stimuli of 300 ms. Decrease-increase C-levels, the child shows their loudness ratings in accordance with our changes in C-levels of stimuli. We repeat the CLS on a few channels. Praise the child.

The final stage of fitting - SHCHUP [2,3].

As you know, objective measures, for example, threshold C-levels of the stapedial reflex, play a small role as indication of the optimal MAP profile [8] and therefore it is necessary to use subjective estimates to determine the MCL levels. As shown in the study of Sherlock P, Formby C [9] a simple loudness discomfort level estimate of loudness discomfort is an effective and valid clinical measure for characterizing the "threshold of discomfort". This is why we developed our SHCHUP method in which we use special step noises [2,3]. With help of the SHCHUP, we determine the C-levels of electrical stimuli at which the child perceives sound stimuli of 106 dB SPL at the level of discomfort threshold, i.e. these C-levels are equal to the electrical upper tolerance levels. We open the test program 23 which is slightly lower in C-levels than the MCLs of the old working program 21. According to the results of our CLS the loudness of program 23 is in the area LOUD. Step noises are ready. Turn on the amplifier. We connect the antenna of the implant to a long wire, place it on the patient's head, and

the processor under the circumoral embouchure of the phone, to which we will apply SPL-controlled step noises. We activate the test program 23 and conduct the SHCHUP in accordance with the previously described procedure [2.3]. We compare the MCL levels of the old working program 21 and the C-levels of our test program, corrected according to the results of the SHCHUP. In those channels where C-levels of a test program are lower than the MCL levels of the old work program 21 we raise C-levels to the MCL levels of work program 21. We do not change C-levels of our test program where these C-levels above the C-levels of the old work program 21. We save the test program under number 25. Now it is a new work program and C-levels slightly differ from the old work program 21. we check the new work program 25 with a live voice, sometimes slightly increasing the loudness of the conversation. Setup is complete. We release the child from the equipment. Thank him. I shake his hand.

Creating of Configuration

Child clearly chose the working program after the first session of fitting (mother's story). The difference in C-levels between consecutive MAPs of 1-2-3-4 was 3 steps. Now we have created a new working program 25 and considering the child's auditory experience we are making new programs with a difference between MAPs' C-levels of 2 steps. We write the program 25 as MAP2. It is configured on the results of the SHCHUP with correction for the MCL values of the old working program 21. We create the other MAP levels like this. We reduce the MCL levels of program 25 by 2 steps (program 26-MAP1), increase the MCL levels of program 25 by 2 steps - program 27 (MAP3), and increase the MCL levels of program 25 by 4 steps (program 28 (MAP4). We create a new configuration with these MAPs. Current thresholds levels (t-levels) are set at 10% of C-levels. You can set t-levels less than 10% [10]. It should be noted that for most children, the entire procedure described here is performed within one hour. And all the SWEEP, CLS, and SHCHUP methods are executed successfully. Parents are sent to evaluate new programs observing the child's behavior on all programs for 2-3 days. The absolute goal is to provide the patient (child) with a comfortable program which ensures maximum performance [11]. If parents and the child choose the working program that is on MAP3, then you can create a new program 29, which is 2 steps higher than program 28 and then the last configuration will be as follows: MAP1 (program 25), MAP2 (program 27), MAP3 (program 28) and MAP4 (program 29).

As we wrote earlier, parents can adjust the MCL levels of the work program using the (+) and (-) buttons of the remote control. If subsequent fittings are made in other centers by another audiologist, then proceed as follows. Perform telemetry, ask which program is working, open it and at the suggestion of "Maestro" to change telemetry, agree and write the new values of the resistance of the electrodes in the working program. Save this program without changing the values of the MCL levels - only with the new telemetry. Then make the necessary adjustments to the threshold and C-levels in the work program and save it. From it, make the program quieter (MAP1) and louder (MAP3) and record the new working program as MAP2. Create a new configuration in which the old working program is written as MAP4. Explain to parents the position of programs on the buttons on the remote control. Give parents an instruction to compare the behavior and perception of the child on the previous and the new created working program and choose the best one. Should not be thoughtlessly (or thoughtfully?!) leave-save the program on the fourth MAP, which the child may not have used – not all patients choose the program at fourth MAP as optimal-working program.

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