

Automatic ECAP Measurements with AutoART

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This is a brief overview of the technical aspects of AutoART, the new automatic ECAP measuring tool in MAESTRO 7 system software from MED-EL.

AutoART is a new software tool from MED-EL that can be used to record electrically evoked compound action potentials of the auditory nerve, typically called ECAPs. AutoART comes with a pre-filled setup, an innovative way of stimulating and recording as well as completely automatic analysis. At the same time, it is the fastest automatic ECAP measurement tool on the market.^{1,2,3,4,5,6}

Setup

The setting of the parameters is done by the system itself based on results from past studies and furthermore considering impedance results, so that using AutoART, audiologists can completely focus on patients without dealing with technical aspects of the recordings.

Stimulating and Recording

In AutoART, the stimulation intensity is increased continuously in very small steps. This results in a predictive loudness increase, enabling recipients, especially children, to signal uncomfortable loudness early. At the same time, the continuous increase using small steps allows for a precise threshold estimation.

Additionally, the recording of the ECAPs is now using multiple recording electrodes instead of only one. This redundancy increases the success rate and is used for artifact reduction. To the recipient, it does not pose an audible difference nor does it prolong the measurement.

The pre-defined sequence of stimulation electrodes that switches between middle, apical and basal channels ensures that—even if the recording needs to be cancelled—the professional always receives recordings from well-distributed regions of the cochlea.

The post-operative recordings typically require less than three and a half minutes, while intraoperatively, the total measurement time is 90 seconds. In addition, an intraoperative “pre-check” is offered that reports ECAP presence after about 30 seconds.

Automatic Analysis

During the recording, the ECAPs are automatically analyzed involving several physiological properties like firing, latencies and intensity-related excitation of auditory nerve fibers. A reliable and robust analysis is ensured by a combination of the following steps:

1. ECAP classification based upon the physiologic firing, latencies, & morphology characteristics (extrema of ECAP curves) that are determined with respect to the whole amplitude growth sequence
2. Analysis of the amplitude growth with respect to the physiologic growth behavior based on firing probabilities
3. Identification of artifacts, calculation based on multiple recording electrodes

As soon as the system reports successful threshold determination, the stimulation on this channel is automatically stopped and AutoART immediately proceeds on the next scheduled channel. This avoids overstimulation of the CI recipient and ensures an optimal recording time.

Application

A first application is—as for the existing ART task—the confirmation that the interface between the cochlear implant and the auditory nerve is working.

Another primary objective of the measurement is to consider the physiological properties of the nerve. Accordingly, the information obtained through the AutoART measurement is not reduced to ECAPs threshold determination alone. From the slope of the growth function very useful information for longitudinal monitoring is available, it has promising potential to inform on the neural health of the auditory nerve.⁷ And it is to be noted that this information is already available within the AutoART measurement without the need to apply further measurements.

As another new feature, MAESTRO 7 offers using AutoART results as a starting point for first fitting:

ECAP threshold profiles are used to estimate the profile of upper limit of the electrical dynamic range (MCL). This is used to [create a map based on the ECAP thresholds profile.](#)

However, ECAP thresholds for all electrode channels or CI users may not be available. This can be the result of various factors, such as the distance between the nerve fibers and stimulating electrode, individual anatomy characteristics, and other factors.

Testing

Overall, AutoART has been tested in more than 75 subjects including 20 children, and in all cases the stimulation was comfortable for the subjects. The sound was reported to be like a cricket, a frog, or a vacuum depending on the frequency of the stimulated electrode.

In conclusion: AutoART provides a safe, easy to apply, reliable and very fast way to record ECAP thresholds and slopes.

*Not all products, indications, and features shown are available in all areas. Please contact your local MED-EL representative for more information.

References:

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