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Two different approaches to record electrically evoked compound action potentials: Comparison of Recording Success, Threshold Determination and Feasibility of simultaneous Stapedial Reflex Recordings

Presenter Bio:

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Abstract:

Introduction: Electrically evoked compound action potentials (ECAPs) can be used to monitor neural nerve status or to support adjusting settings of a Cochlear Implant (CI). For deriving specific settings like the maximum stimulation level, stapedius reflex recordings are more suitable.

The ECAP threshold, reflecting the minimum stimulation intensity where an ECAP can be detected, is typically derived via two alternative methods: a) By an Amplitude Growth Function (AGF), which plots ECAP amplitudes as a function of the stimulation intensity or b) by manually identifying the first visual ECAP appearance within the recorded curves.

Here, we evaluated both definitions with two different ECAP recording approaches: a traditional method where the stimulus is presented in defined steps with manual interpretation of results and a fully automated novel approach where the stimulus is presented in a continuous fashion. The derived success rates and ECAP thresholds were compared. Furthermore, success of simultaneous stapedius reflex recordings was evaluated.

Methods: The study population consisted of 12 paediatric CI users aged between 1-16 years. ECAP recordings were collected with the clinical software MAESTRO at 44Hz stimulation rate and a research software termed "FineGrain" at stimulation rates of 40Hz and 80Hz. The evoked stapedius reflex was recorded during the ECAP recordings.

Results: ECAP recordings showed similarly high (> 90%) success rates across all conditions. Evaluation of individual electrodes revealed higher recording success in the basal region using 80Hz stimulation rate than 40Hz. AGF-Thresholds did not differ between the traditional and novel recordings (for all stimulation rates). First-visual thresholds did diverge: using the traditional method, first-visual thresholds were significantly higher compared with FineGrain at a similar stimulation rate (44Hz and 40Hz). Stapedial reflex recordings showed substantially higher recording success with the traditional approach compared to FineGrain. However, detection of the reflex was more difficult with the continuous stimulation as employed by FineGrain.

Conclusion: ECAP recordings showed comparable results in terms of success and AGF-based threshold determination, but FineGrain was faster: a recording for all 12 electrodes lasted circa 2.5 minutes compared to 4 minutes with the traditional approach, whereby the time to manually inspect the AGF for the traditional method is not included. We believe the FineGrain approach is a reliable and fast replacement for the traditional method in clinical practice for ECAP recordings. For pursuing particular research aims, like simultaneous ECAP and ESRT recordings, FineGrain is not ideal and should be evaluated on a case-to-case basis.

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Learning Objectives (Complete):**Objective 1*:**

: Compare different protocol of detecting Electrically evoked compound action potentials in children with cochlear implant

Key Words for Objective 1*:

: Electrically evoked compound action potentials

Objective 2:

: relate the presence of the Electrically evoked compound action potentials to the presence of the stapedial reflex

Key Words for Objective 2:

: amplitude growth function

Status: Complete

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