N. 61 - ABR TO BONE-CONDUCTED TONES IN INFANTS WITH CONDUCTIVE OR SENSORINEURAL HEARING LOSS

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The published bone-conduction (BC) tone-ABR literature, especially for infants with sensorineural hearing loss, is surprisingly lacking despite over two decades of successful clinical use. Importantly, no study has evaluated the test performance of the BC tone-evoked ABR in infants. Therefore, the current studies investigated: (i) whether the BC tone ABR was successful in differentiating children with conductive versus sensorineural hearing loss (Study A), and (ii) the relationship between BC ABR and subsequent behavioural hearing loss severity (Study B). **Study A.** By comparing BC ABR results (normal vs elevated) to behavioural results, Study A evaluated the accuracy of the BC ABR in correctly identifying type of hearing loss in a large group of infants with hearing loss (Conductive: 66 ears; SNHL: 109 ears). Results demonstrate that the normal BC ABR levels (500 Hz: 20 dBnHL; 2000 Hz: 30 dBnHL) accurately differentiated normal versus elevated cochlear sensitivity (accuracy=96.7% for 2000 Hz; 96.2% for 500 Hz). **Study B.** A subset of infants in Study A with elevated BC ABR (i.e., no response at normal level) had additional testing at higher intensities (usually at the maximum levels), which allowed for the categorization of the degree of cochlear impairment (normal, mild/moderate; moderate/severe). Results indicate that the BC ABR accurately categorizes the degree of cochlear hearing loss, for at least 2000 Hz (accuracy=92.8%). BC ABR categorization results at 500 Hz were similar to 2000 Hz; however, interpretation is limited due to the small number of ears at 500 Hz. Finally, for a few cases with elevated BC ABR (N=10), actual BC ABR thresholds were obtained. These latter results were used to calculate preliminary dB nHL to dB HL correction factors (mean -0.5±9 dB) for 2000 Hz BC ABR. Overall, these findings provide further support for the use of BC tone ABR for diagnostic ABR testing.

N. 62 - REDUCING RECORDING TIME OF BRAINSTEM AUDITORY EVOKED RESPONSES BY THE USE OF RANDOMIZED STIMULATION

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Many protocols for newborn and infant hearing screening incorporate the acquisition of Brainstem Auditory Evoked Responses (BAER). This evoked potential represents the neural activity associated with the auditory brainstem function in response to a sound stimulus. The biological response waveform is characterized by a series of positive waves that occur during the first 10msec after stimulus presentation. Since wave V is the most robust wave, it is usually used as indicator of hearing loss. The conventional acquisition technique elicit the biological response by presenting to the patient a pulse train with a fixed inter-stimulus interval (ISI) and averaging then the response to each stimulus. Usually, more than 1500 responses must be averaged to obtain a reliable biological response. The exploration time is therefore the main limitation in the recording of these potentials. This preliminary study presents a novel technique to reduce the recording time. Instead of using a pulse train with a fixed ISI, we propose to elicit the biological response by using a pulse train with a random ISI. To analyze the feasibility of the proposed technique, the BAER of four normal hearing adults were acquired considering the following inter-pulse intervals: ISI_{25} (conventional technique), ISI_{3-8} (uniformly distributed random inter-pulse interval in the range from 3 to 8msec), ISI_{5-10}, ISI_{8-13}, ISI_{10-15}, ISI_{15-20} and ISI_{20-25}. The recordings confirm that the hearing threshold can be determined in a shorter time using the proposed technique since the sound intensity threshold at which wave V appears is similar in both conventional and proposed techniques. Although the waves recorded with the proposed technique present lesser amplitudes and greater latencies due to adaptation, a fast detection of the wave V facilitates the implementation of newborn and infant hearing screening protocols.

N. 63 - CIRCULAR PHASE CLUSTERING BASED AUTO-ADAPTATION FOR THE OBJECTIVE ASSESSMENT OF ABR MEASUREMENT QUALITY

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The objective assessment of the measurement quality of auditory brainstem responses (ABRs) recently became an important component of clinical practice/hearing screening. Most of the known ABR quality measures are based on simple morphological time-domain features such as amplitude and latency, e.g., by comparing single ABR sweeps to the averaged response. However, such morphological approaches may suffer in measurement conditions in which externally induced noise cannot be further reduced and thus result in a weak morphological stability of the ABR response. To approach this problem, we present a new quality measure which is based on the circular clustering of the instantaneous phase of ABR single trials, i.e., a correlate of neural synchronization processes. For this, band-limited Hardy space projections are employed to obtain the instantaneous phase of consecutive ABR single-trials which are arranged in a matrix representation. In this representation the instantaneous phase is evaluated along a fixed trace by means of directional statistics on the unit circle. The quality measure is now derived from the circular difference of the phase distribution of trials of the spontaneous activity, i.e., no auditory stimulation, from the distribution of trials after auditory stimulation. Twenty subjects (mean age approx. 25y, std: approx. 4y) with no history of hearing problems and normal hearing thresholds (below 15 dB (HL)) participated in our study. ABR single trials were obtained by calibrated broad band chirps at 20, 30, and 40 dB SPL and in the case of no stimulation, i.e., the spontaneous activity. Using these data, we show that our approach (a) allows for an auto-adaptation to the measurement condition, (b) allows for a robust and objective quantification of the measurement quality, and (c) can also be used for the objective ABR detection with a minimum number of trials by combining it with novelty detection machines.

N. 64 - EFFECTIVE MASKING LEVELS AT 500 AND 2000 HZ FOR BONE-CONDUCTION AUDITORY STEADY-STATE RESPONSES IN INFANTS AND ADULTS WITH NORMAL HEARING

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Objective. Few studies have investigated appropriate masking levels for obtaining ear-specific bone-conduction thresholds in infants. In this study, effective masking levels (EMLs) for auditory steady-state