1. Date of test:
2. Modality:  Visual  Auditory  Somatosensory  Other, specify:
3. Stimulation parameters:
   1. Visual
      1. *Type*:  checkerboard  flash  gratings  other, specify:
      2. *Wavelength*:  black & white/white  color (define)
      3. *Spatial frequency (for patterns)*: defined as the visual angle subtended by pattern elements
      4. *Total field size*: in degrees of visual angle
      5. *Temporal frequency*: defined as rate of alternation/presentation in Hz (number of full cycles/second)
      6. *Stimulus luminance*: (cd/m2)
      7. *Contrast*: defined in % as the difference between the dark and bright portions of a pattern
      8. *Model of stimulator:*
   2. Auditory
      1. *Type*:  tone burst (specify, frequency \_\_ / duration \_\_)  click  other, specify:
      2. *Side:*  binaural  left  right
      3. *Intensity:* in decibels above sensation level (dB SL) – 4 intensities (10dB steps) in random order for study of intensity dependence:
      4. *Repetition rate:* expressed as interstimulus interval in msec:
      5. *Model of stimulator:*
   3. Somatosensory
      1. *Type*:  electrical  tactile  vibratory  other, specify:
      2. *Site*:  peripheral nerve,  skin,  other, specify:
      3. *Intensity:* in mA for electricalstimuli
      4. *Repetition rate:* in Hz
      5. *Model of stimulator:*
4. Recording parameters:
   * 1. *Electrode type & positioning:*  10-20 reference system  surface/needle  number  active  reference
     2. *Bandwidth: low-high in Hz*
     3. *Analysis time: in msec*
     4. *Sampling rate: in Hz*
     5. *Type of responses recorded:*  transient  steady-state  broad band  high frequency
     6. *Averagings:*  on-line  off-line (recommended)
        1. *Total number of responses:*
        2. *Block averagings:* 
           1. number of responses per block:
           2. number of sequential blocks (visual/somatosensory):
           3. number of different stimulus intensities (auditory):
     7. *Recording device and pre-amplifiers:*
5. Analysis of responses:
   * 1. *Evoked potential components:*
        1. define components & criteria for their identification:
        2. define harmonics for steady-state EPs:
     2. *Measurements:*
        1. Amplitudes:  peak-to-peak  AUC
        2. Habituation (or adaptation):
           1. percentage between 1st & last block:  yes  no
           2. slope over all blocks (in μV/block)  yes  no
        3. Intensity dependence (for auditory EPs): defined as the amplitude/stimulus intensity function (ASF) slope (in μV/10dB):  yes  no
        4. Time-frequency analyses for steady-state EPs (amplitude & phase):  yes  no
        5. *Latencies:* in msec (for transient EPs):  yes  no
     3. *Blinded:*  yes  no
6. Timing of recordings:  ictal  inter-ictal  peri-ictal
   1. If ictal, pain intensity at time of recordings:
   2. If ictal, duration of time since onset of headache (include units):
   3. If inter-ictal or peri-ictal, duration of time since end of last headache (include units):
   4. If inter-ictal or peri-ictal, duration of time until start of next headache (include units):

General Instructions

This CRF contains questions that should be answered when evoked potential studies are used in headache research. Inclusion of standardized instructions to subject should be included in the CRF instructions module.

Cortical Evoked Potentials (EPs) have been studied extensively in headache research and could have some diagnostic utility in patients with uncertain diagnosis. The most frequently studied EP is the visual evoked potential. Depending on the stimulation pattern and the recording parameters transient or steady-state potentials can be recorded. The former are averaged global neuronal activities triggered by the stimulus, the latter are brain waves generated at the same frequency as the internal frequency of the train of stimuli or at a harmonic of this frequency. As this CRF deals chiefly with transient EPs, supplementary methodological details on steady-state EPs can be found in the review by (Norcia et. al., 2015).

High frequency oscillations are embedded in the classical broad-band EPs. They can be extracted using appropriate filters and have a pathophysiological interest (Coppola et. al., 2005, 2007).

Besides modality-specific EPs generated by an exogenous stimulus, cortical potentials can also be produced endogenously by an internal cognitive or motor process. These potentials are sometimes called “event-related potentials” (ERPs), although this term has also been applied to designate both exogenously and endogenously evoked potentials as “the general class of potentials that display stable time relationships to a definable reference event” (Vaughn 1969 cited in Norcia et al. 2015). The ERPs most studied in headache research are the contingent negative variation recorded in a reaction time paradigm and the P300 potential obtained in an oddball paradigm of sensory stimuli. These activities are not addressed in this CRF.

## Headache or migraine specific elements/measures that are not captured on this form, but are important to the neurophysiological analysis should be collected on other study-specific source documentation (e.g. Headache Diary, Concomitant Medications, delay between the EP recordings and previous or next headache attack..)

Important note: All elements on this CRF are considered Supplemental and should only be collected if the research team considers them appropriate for their study.

## Specific Instructions

Please see the Data Dictionary for definitions for each of the data elements included in this CRF Module.

* Date of test – Record the date/time according to the ISO 8601, the International Standard for the representation of dates and times ([Please click here for the International Organization for Standardization website](http://www.iso.org/iso/home.html)). The date/time should be recorded to the level of granularity known (e.g., year, year and month, complete date plus hours and minutes, etc.).
* Modality – choose one
* Stimulation parameters:
  + Visual – wavelength: define wavelength for colored light
  + Visual – spatial frequency: visual angle subtended by pattern elements in minutes of arc, 1°8`recommended.
    - To calculate: a=arctan(W/2D)x120, where a is the visual angle in minutes of arc, W the width of the checks in millimeters and D is the distance of the pattern from the corneal surface in millimeters, or cycles per degree (30/a for bars, 42.3/a for checks)
  + Visual – total field size: provide response in degrees of visual angle; ideally values greater than 8°
  + Visual – temporal frequency: defined as rate of alternation/presentation in Hz (number of full cycles/second); typical 1.65 Hz for patterns, 8-20 Hz for SSVEP
  + Visual – stimulusluminance: provide values in cd/m2; ideally at least 50cd/m2 of the center field
  + Visual – contrast: difference In luminance between dark and bright elements of a pattern expressed in % as {C=(Lmax-Lmin)/(Lmax+Lmin)x100%}; ideally between 60 and 95%
  + Visual – analysis time: 250ms for transient VEP, 2 sec for SSVEP
  + Bandwidth – visual: 1.0 (low) to 250-300Hz (high), auditory: 0.1-0.3 to 30-100Hz
  + Auditory – type: for tone burst, indicate frequency and duration
  + Auditory – intensity: 40, 50, 60, 70 dB above sensation level (dB SL) are recommended, or above the normal hearing level (dB nHL) if there is a hearing loss. The different stimulus intensities should be administered in a randomized or pseudo-randomized order, with the intensity not being the lowest or the highest. Because of potential harm to the inner ear, the International Bureau for Audiophonology recommends to exclude subjects with an average hearing loss above 20dB.
  + Analysis of responses – evoked potential components – identified on the basis of their phase and latency range
  + Blinding – blinding is highly recommended for the analysis of the recordings, although a comparative study found no difference between blinded and non-blinded analyses of VEPs in migraine (Ambrosini et al. 2016). Blinding is optional for the recording procedure
  + Timing of recordings – since cortical EPs may undergo drastic changes just before, during and after a headache attack, it is crucial to mention the timing of recordings in relation the headache.
    - The precise time windows for peri-ictal and inter-ictal vary with headache type. For episodic migraine, an interval of at least 72h from the last and before the next attack is generally accepted for “inter-ictal”. In migraine with aura, it must be specified if the recordings are performed during the aura, during the headache or during the co-existence of both.

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