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Methods: 14 healthy subjects (29.35 ± 14.40 yrs, 7 females) were equipped for 13.3 ± 2.58 h with portable polysomnography (pPSG), while wearing the Axivity AX3. The AX3 was set to record 3D accelerations at 100 Hz, with a dynamic range of ±8 g coded at 10 bit. For the automatic actigraphy-based sleep detection, a 4 layer artificial neural network has been trained, validated and tested against the pPSG-based expert visual sleep-wake scoring.
Results: When compared to the pPSG gold standard scoring, the ANN-based algorithm reached high concordance (85.3 ± 0.06%), specificity (87.3 ± 0.04%) and sensitivity (84.6 ± 0.1%) in the detection of sleep over 30-sec epochs. Moreover there were no statistical differences between pPSG and actigraphy-based Total Sleep Time and Sleep Efficiency measurements (Wilcoxon test).
Conclusions: The high concordance rate between ANN-actigraphy scoring and the standard visual pPSG one suggests that this approach could represent a viable method for collecting objective sleep-wake data using a high performance, open source actigraph.
Disclosure: Nothing to disclose.

P514

Automatic artefact detection in long-term single channel sleep EEG recordings

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Objectives: EEG recordings may contain artefacts from many different sources, which is detrimental for quantitative signal analysis. Thus, artefacts should be corrected or rejected.
Methods: We analysed two datasets, the first one was comprised sleep recordings of 18 healthy male subjects (3 nights per participant, 54 nights in total). Second dataset included continuous PSG recordings obtained in five patients with hypersomnia and narcolepsy during sleep and Multiple Sleep Latency Test (MSLT), in total 10 recordings. We applied 14 different algorithms to one of EEG derivation and evaluated their performance using cross-validation. For 12 of the algorithms (e.g. thresholding of specific variables, auto-regressive models) we used training set to derive the parameters (determining thresholds). We used both predefined parameters and parameters derived from statistical properties of the signal. For the other two algorithms (K-means, hidden Markov model) we employed unsupervised leaning, thus a training set was not needed.
Results: We computed receiver operator characteristic (ROC) curves along with true and false positive rates for 12 supervised algorithms and true and false positive rates for the two unsupervised ones. Algorithms with fixed parameters (thresholds) performed better than those with adaptive parameters. Unsupervised algorithms performed well on the MSLT datasets and poorly on the sleep data.
Conclusions: We could effectively reject epochs with artefacts with most of the algorithms. Best performance was obtained with thresholding of high frequency power. It is likely that we can further improve performance using machine-learning techniques.
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Disclosure: Nothing to disclose.

P515

Efficiencies gained by remote monitoring of CPAP treatment

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Objectives: To investigate efficiency and effectiveness of treatment of Obstructive Sleep Apnoea by Remote Monitoring of CPAP compliance.
Methods: Patients Diagnosed with Obstructive Sleep Apnoea were issued with auto-setting CPAP machines Patients were remote monitored by telephone or Skype at regular intervals (weekly for the first two weeks), then less frequent or as required thereafter. They attended the Sleep Centre after 4 weeks to have weight and mask fit checks by physiologists. More intense consultation was available if required. After three months trial patients were interviewed by senior physiologists to determine whether they needed further input from the staff in a clinic or whether they preferred to continue on the remote monitoring system. Compliance figures were compared with those of traditional follow-up systems.
Results: Costs: Savings occur in Patent Costs, Public Transport costs and Social Service costs of CPAP treatment. Reductions in costs associated with Time Off work to attend clinics and reduced need for ambulance transport, car parking spaces and internal porter services were experienced.
Clinical Space Savings: 1500 patients require 7500 traditional clinic visits per year. Remote Monitoring requires only 3000 for remote monitoring resulting in 4500 extra clinic room spaces being available per year.
Efficiency Savings: Clinical discussion time per patient is not significantly less with remote compared with in-clinic interviews. Clinical efficiency increased. Multitasking increases efficiency.
Disclosure: Nothing to disclose.

P516

Linking the quality of sleep and cognitive performance in stroke patients

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Objectives: The goal of our study is to find correlations between individual characteristics in sleep EEG and cognitive performance in stroke patients.
Methods: Characteristics in sleep EEG spectra were computed for the Rechtschaffen and Kales sleep stages. For testing the cognitive performance we created computerized versions of three psychological tests (on attention, working memory and fine motor skills) and of the reaction times (RT) test. Attention was measured by the lateralized version of Attention network test (ANT), with parameters adjusted for our research group ($n = 21$) of senior patients after stroke. Working memory was assessed by the standard Digit span test (repetition of digits backwards). Fine motor skills were tested by the task of redrawing given patterns by hand using the pen tablet. Cognitive tests were performed during the day after the EEG sleep monitoring.

Results: We found that a specific behavioral component of attention (orienting facilitatory component, defined as a difference in RTs in no-cue and valid-cue conditions) as well as simple RT, were correlated with a total length of wake time periods ($P < 0.01$) at the beginning of nigh and the number of awakening ($P < 0.01$) during the night. No correlation was found between sleep measures and working memory performance or motor skills.
Conclusions: Our results indicate that there may exist an association of certain sleep characteristics of stroke patients with a specific behavioural component of attention and with reaction times during the next day, but not with working memory and motor skills. (supported by project SR-2012/56-SAV-6)
Disclosure: Nothing to disclose.

P517

Graph-theoretic analysis of nocturnal EEG recordings for NFLE patients and controls

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Nocturnal EEG recordings during sleep for 16 NFLE patients and 11 healthy controls were acquired. For each recording (19 channels EEG with 256 Hz sampling frequency) we compute the spectral coherence between each pair of channels and use the values to build weighted undirected graphs. The coherence analysis is performed for all events identified as CAP-A1 phase (4 seconds duration) by a human expert, over the extended alpha band (4–15 Hz). An average graph is obtained for each participant and finally the average graphs for the two groups are computed. By applying a set of graph-theoretic analyses to the two average graphs we observe a different network connectivity structure for cases and controls: the latter show a uniform distribution of spectral coherence over most pairs of channels, while the former display an unbalance between frontal (lower than normal connectivity) and occipital-parietal lobes (higher than normal connectivity). The node degree of each channel is also used as an indicator of synchronization among different areas of the scalp activity. The differences in the connectivity structure hold not only when comparing group averages, but also for the majority of case-control pairs taken individually.
Disclosure: Nothing to disclose.

P518

Application of Clean Unit System Platform (CUSP) for sleep diagnostics: evaluation of sleep quality by monitoring air-borne particles in an ultraclean space

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Objectives: Polysomnography (PSG) is the gold standard test for diagnosing sleep disorders. However, patients should be connected to a variety of monitoring devices that might affect their sleep quality. We recently proposed a novel Clean Unit System Platform (CUSP) to establish a dust/microbe-free environment for various purposes. Tent-type CUSP enables us to detect fluctuation of air-borne particle counts as bio-kinetic signals reflecting body movements during sleep, which we designated as "kinetosomnogram" (KSG). Our goal is to investigate whether the KSG is of any use in evaluating sleep quality.
Methods: We validated air-cleansing capacity of the tent CUSP and recorded changes in particle counts in response to various body movements. A volunteer with a PSG equipment stayed in the tent CUSP overnight to record a KSG. The KSG was compared with PSG sleep stages, and was subjected to power spectral analysis.
Results: Air quality was improved from 50,000–150,000/cubic feet (cf) to 0–300/cf in 5 minutes. A bout of body rolling caused a surge of air-borne particles with a peak of 3000–6000/cf in a minute, and raising a hand or a leg did the same with a peak of 1000–2000/cf. Each surge in the KSG appeared to have a corresponding arousal response (stage W) in the PSG. Moreover, there was a significant peak of power spectral density at 80–100 minutes suggesting of REM periods.
Conclusions: The tent CUSP provides us with ultraclean environment for sleep and would be of significant help to assess sleep quality in a non-invasive and non-contact manner.
Disclosure: Nothing to disclose.

P519

In-depth analysis of leg movements during sleepin 3D

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Objectives: To compare signatures of leg movements (LM) as detected by electromyography (EMG) of the tibialis anterior muscles and automatic 3D analysis.
Methods: Our 3D analysis system uses a novel 3D sensor and computes selected features in the spatial, temporal and frequency domain to detect and classify motor events.
Video-polysomnography (PSG) and 3D sleep data were recorded in a multi-centric study with patients presenting with frequent LM during sleep. 25 recordings with 3D and clean EMG data were selected. Deflections in EMG signals were compared to automatic detections of LM in 3D.
Results: In 6 patients more than 50% of the LMs seen in 3D were not detected by EMG (maximum 88.1%, 42.6% on average over all patients). In contrast, in 9 patients more than 30% of the deflections in EMG did not correspond to visible movements (maximum 82.6%, 25.0% on average of all patients).
Conclusions: EMG deflections qualifying for LM can indicate either tonic muscle contractions (without visible movements) or clinically relevant movements. In contrast, LMs caused by other muscles than the tibialis anterior muscles are missed in PSG recordings, but are visible in 3D. In all these cases, 3D analysis of sleep-related LMs provides more reliable data on these clinical phenomena. Using 3D analysis, a "real-life" LM- and hence also PLM-index can be computed, because only clinically relevant movements are to be incorporated. Another advantage of the 3D technology in clinical