area of interictal magnetoencephalography. Then, we investigated the relationship between the magnetoencephalographically abnormal area and the resected temporal lobe.

Results: Repeated spikes were observed from only one patient, but no repeated spike from four patients during ictal state. Theta waves were observed from all five patients in this series. The repeated spikes were localized in the temporal base on the magnetic source image. The magnetic source origin of ictal theta waves analyzed by the spatial filter were estimated in the resected temporal lobe of all patients. The interictal magnetic source images indicated the resected temporal lobes.

Conclusion: Ictal magnetoencephalography of the temporal lobe epilepsy was inclined to show the theta rhythm. In this series, the initial onset areas analyzed by the spatial filter were situated in the resected temporal lobes.

Poster: 2-3 Clinical MEG: Motor function disorder

2-3-1: Auditory evoked fields in patients with advanced Parkinson’s disease during deep brain stimulation
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We investigated the effects of deep brain stimulation (DBS) of subthalamic nucleus (STN) on the auditory evoked magnetic fields (AEFs) in Parkinsonian patients. DBS of STN relieves symptoms of the advanced Parkinson’s disease (PD). DBS inhibits abnormal over-activity of STN, and possibly disinhibits the thalamocortical pathways. Artifacts caused by stimulation have precluded MEG studies of patients with DBS. We used a new artifact suppression method termed signal space separation with temporal extension (tSSS) to study possible changes of AEFs by DBS. MEG measurements were done with a 306-channel magnetometer (Elekta Neuromag?), in seven patients with Parkinson’s disease treated with STN stimulation, both when stimulation was on and off. Medication was not changed. AEFs were elicited by 1-kHz tones delivered to each ear separately. Responses at 50 ms (P50m) and at 100 ms (N100m) after the stimulus onset were identified and their amplitudes and peak latencies were compared across conditions (stimulation on and off). The measurement noise was estimated from the prestimulus baseline. The difference between the amplitudes of the two responses was considered significant if it exceeded two S.D.s of this noise. DBS stimulation changed P50m in 5 patients and N100m in 4 patients in the hemisphere contralateral to the delivered tones. P50m increased significantly in 5 and decreased in 3 out of 14 contralateral hemispheres during DBS. N100m was increased significantly in 2 and decreased in 2 contralateral hemispheres. The latencies were non-significantly shorter when the DBS was on. These preliminary results suggest that DBS affects more the generators of P50m than those of N100m in advanced PD.

2-3-2: Cortical processing of swallowing in ALS patients with rapidly progressive neurogenic dysphagia
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The cortical areas controlling swallowing are located bilaterally in the somatosensory cortex in healthy subjects. Sensory disruption leads to bilateral decrement of the observed cortical activation mainly in the sensory but also in the motor system. Little is known about the development of cortical activation in patients with fast progressive dysphagia due to motor impairment. Amyotrophic lateral sclerosis (ALS) is a rare disease causing degeneration of the upper and lower motor neuron. It often results in fast progressive bulbary affection leading to dysphagia and later on to respiratory failure. We investigated the pathophysiological mechanisms and cortical activation during deglutition in ALS patients in different stages of dysphagia. Whole-head MEG was employed on fourteen patients with bulbary ALS to study cortical activation during self-paced volitional swallowing. Data were analyzed by means of synthetic aperture magnetometry (SAM). Group analysis of individual SAM data was performed using a permutation test. We found a reduction of cortical swallowing related activation in ALS patients compared to healthy controls. Additionally a disease-related shift of hemispheric lateralization was observed. While healthy subjects showed a slightly stronger left hemispheric activation, the right sensorimotor cortex was predominantly involved in ALS patients. Both effects were even stronger in the advanced stage of the disease. Our results suggest that degeneration of cortical neurons leads to reduction of swallowing related cortical activation due to impairment in the recruitment of other motor areas and/or adaptive changes in brainstem structures. On the other hand the right hemispheric shift gives hints for cortical plasticity.
Abstract / Poster: 2-3 Clinical MEG: Motor function disorder

2-3-3: Oscillatory Network Beneath the Effects of Subthalamic Nucleus Deep Brain Stimulation on Parkinsonian Tremor: An MEG Study

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We have observed significant improvement in pathological movement in Parkinsons disease patients after deep brain stimulation on the subthalamic nucleus. However, there are still poor understandings of the mechanism following DBS. We have studied MEG and EMG data from a total of 3 tremorous Parkinsons disease patients, during resting state and isometric motor contraction with thumb abductors who underwent bilateral STN DBS surgery. We compared the EMG and MEG oscillatory patterns when the DBS was OFF and ON respectively. We investigated the coherence between primary motor cortex (M1) and EMGs (flexor carpi radialis (FCR), abductor policis brevis (APB) to find the relationship between the two. Whole head MEG data and EMG signals were obtained from Parkinsons disease patients in both DBS OFF and ON states. Coherence was calculated in the frequency band of 1-40Hz from refined data. EMG raw data were studied also in order to monitor tremor activities. FCR EMG-M1 coherence in the rolandic area is prominent around tremor frequency and its harmonics when DBS is OFF for resting state data, which tends to diminish when the DBS is ON. Also APB EMG-M1 coherence in the \( \beta - \gamma \) band increased during DBS ON compared to the respective DBS OFF state results, which corresponds to previous normal studies on isometric motor output coherence. We concluded that the coherence tends to approach the normal motor activity data when DBS is ON. We speculate that the stimulation on the STN may modulate phase synchrony between basal ganglia and M1, resulting in better motor output from the M1 to the muscle of the contralateral limb.

2-3-4: Subthreshold rTMS to motor cortex of non-demented Parkinsonian patients increases rolandic mu rhythm

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OBJECTIVE: Parkinson disease (PD) caused by progressive loss of dopaminergic neurons. Repetitive transcranial magnetic stimulation (rTMS) to primary motor cortex (M1) modulates dopaminergic activity in the basal ganglia, but at present rTMS effect remains controversial in PD. We characterized the short-term effects of rTMS by analyzing the spontaneous (SP) magnetoencephalogram (MEG) to see whether subthreshold rTMS to M1 affects the 10-20 Hz oscillations (mu rhythm) in PD patients, and whether the changes correlate with the motor scores.

METHODS: In 9 non-demented PD patients, the hemisphere contralateral to the most affected limb was stimulated with intensity of 80% of patient motor threshold (MT) in two consecutive days. Twenty trains of 100 pulses at 10 Hz were delivered with 1-min inter-train interval. Spontaneous brain activity was recorded with a 306-channel Elekta Neuromag Vectorview MEG instrument. We analyzed spectral power (SP) in alpha and beta bands before and after the rTMS with emphasis on 10-Hz activity and its 20-Hz harmonics. UPDRS scores were measured.

RESULTS: UPDRS scores were improved significantly only on the first day after the rTMS treatment. In 6 out of 9 patients the rTMS significantly increased both the 10Hz and 20Hz mu rhythm oscillations. The first treatment modulated mu rhythm more than the second one. There was no change in the mu rhythm in one patient; in two patients the mu rhythm was reduced. The changes were consistent in both alpha- and beta-range components of the mu rhythm. UPDRS scores and mu rhythm facilitation correlated significantly. Patients reported decrease in rigidity but not in the limb tremor.

CONCLUSION: Mu rhythm may reflect the akinetic features of PD.