The term `changed proprioception` is often used in conjunction with the reconstruction of the anterior cruciate ligament (ACL) and researchers speculate about changes in cortical activity. In order to examine changes in central activation patterns, spectral features of the EEG were measured during two sensorimotor tasks representing different proprioceptive modalities (joint position sense and force sensation) in ACL patients and a healthy control group. Therefore, the aim of the study is to look if the central information processing is influenced by an ACL-reconstruction when performing different sensorimotor tasks.

Ten patients 12.9±4.9 months after ACL-reconstruction and 12 healthy controls participated in the study. The task in the first experiment consist of an active knee angle reproduction (40°) without visual feedback in a sitting position (JPS). In the second experiment the subjects were asked to reproduce 50% of their individual maximal voluntary contraction (MVC) reproduction in the same set up (FS). In both experiments the participants have had the possibility to practice with visual feedback before each trial. The tasks were executed in random order with one week between the experiments and analyzed in a 2 (ACL vs. controls) x 2 (extremities) x 4 (trials á 3 min) design. Performance (aberrations from the target), neuromuscular activation (IEMG of RF, VM, VL) and cortical activity (divided in Theta (4.75-6.75 Hz), Alpha-1 (7.0-9.5 Hz), Alpha-2 (9.75-12.5 Hz) and Beta-1 (12.75-18.5 Hz) frequencies) were measured.

In the JPS task behavioural data show significant higher aberrations in the ACL-reconstructed limb (p<.05) compared to the controls. The neuromuscular activity demonstrates significant lower results of the VM at the involved side in the ACL group (p<.05). The brain activity results in significant higher frontal Theta power (F3: p<.05, F4: p<.01, F8:p<.01) in the ACL-group. Alpha-2 power shows significant differences between the ACL and the control group at parietal positions (P3: p<.05, P4: p<.05). In contrast to the JPS task no significant differences were found in the FS task between the groups neither in the performance nor at the neuromuscular and cortical level.

The results classified the proprioceptive modalities JPS and FS. In detail the influence of an ACL-reconstruction were shown in JPS at cortical, neuromuscular and performance level whereas FS was not affected. Therefore the term changed proprioception after ACL reconstruction should be handled with more care. The ACL patients demonstrated significant higher power in the frontal Theta frequency band. This finding was supported by numerous cognitive and visuomotor studies which describe frontal Theta power as an indicator of focussed attention and task complexity. The frontal Theta frequency is thought to be generated in the anterior cingulate cortex as an important part of the human attentional system. The significant lower Alpha 2 parietal (P3, P4) power in the involved side of the ACL group during the JPS task indicates the notion of higher cortical activation in the parietal regions compared to the controls. Therefore the ACL patients require more neuronal resources in the parietal cortex while performing with the reconstructed side. The results are described as a part of a fronto-parietal network which seemed to represent parts of the visual-spatial working memory. That lead to speculations of measurable different loads of the working memory depending on the proprioceptive modality.

**Keywords:** ACL, Proprioception, Brain Activity