# Morphometric and activation characteristics of the vastus medialis muscle after ACL graft re-tear

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**6 authors**, including:

Eduard Kurz
Martin-Luther-University Halle-Wittenberg, Halle (Saale), Germany


René Schwesig
Martin-Luther-University Halle-Wittenberg


Stefan Pröger
Sportklinik Halle


Karl Stefan Delank
Universitätsklinikum Halle (Saale)

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**Oral Abstracts**

fatigue caused by a prolonged testing period. These novel findings may have relevance for ongoing pain and facilitate the development of novel rehabilitation approaches.

### P1-2: The influence of vibration on trunk proprioceptive control in people with and without low back pain

Alessandro De Nunzio[1], Deborah Falla[2]
*[1]LUNEX International University of Health, Exercise and Sports, [2]University of Birmingham*

BACKGROUND AND AIM: Adaptations in lumbar sensory-motor control are common in people with low back pain (LBP) (Ebenbichler et al. 2001), and compromised lumbar proprioceptive input can contribute to a loss of trunk control and even LBP chronification (Meier et al. 2018). Muscle spindles represent the main proprioceptive receptors. Vibration applied over muscle and therefore muscle spindles, generates an illusion of limb movement (Proske and Gandevia, 2012). This study examined the contribution of the lumbar muscle spindles to trunk control in people with LBP versus asymptomatic controls (AC) by measuring the trunk repositioning error with and without vibration of the lumbar erector spinae. METHODS: Fourteen AC (age: 32.5ą4.8 years) and fourteen people with LBP (age: 37.8ą9.0 years, average pain: 5.6ą2.1/10) participated. An inertial motion sensor attached to the 3rd thoracic spinous process measured the accuracy in adopting and returning to a neutral trunk position after sagittal movement (50° trunk flexion). Lumbar vibration was randomly applied during trials. Three trials were executed for each condition (Vib, No-Vib). The mean trunk repositioning error (TRE) was calculated and statistically evaluated using a two-way repeated-measure analysis of variance (ANOVA) within the two vibration conditions and between the two groups. RESULTS: The mean TRE increased significantly in the LBP group ($p<0.001$) under the Vib condition (5.0ą2.6°) compared to the No-Vib (1.9ą1.7°). No significant differences were found for the AC group ($p>0.05$) between the Vib (2.9ą2.2°) and No-Vib (2.4ą1.6°) condition. The groups did not differ in their mean TRE under the No-Vib condition ($p>0.05$) whereas the TRE was significantly higher in the LBP group compared to the AC under the Vib condition ($p=0.037$). CONCLUSIONS: People with LBP were unable to compensate for the vibration-induced proprioceptive illusion. This study highlights the pivotal importance of lumbar muscle spindles in controlling trunk motion accuracy in people with LBP. The disturbance induced by the vibration generated a significant impairment of trunk control in people with LBP and enhanced the specificity of the trunk repositioning error test.

## Session Rehabilitation 1

### R1-1: Morphometric and activation characteristics of the vastus medialis muscle after ACL graft re-tear

Eduard Kurz[1], René Schwesig[1], Stefan Pröger[2], Karl-Stefan Delank[3], Gisela Stoltenburg-Didinger[4], Thomas Bartels[2]

*[1]Martin-Luther-University Halle-Wittenberg, [2]Sports Clinic Halle, [3]Martin-Luther-University, [4]Charité Universitätsmedizin Berlin*

BACKGROUND AND AIM: After primary ACL reconstruction, a second injury likely occurs within a time frame of 24 months. Rehabilitation programs aim therefore to re-establish function and to address modifiable risk factors for re-injury. An important risk factor which can be modified are neuromuscular alterations. This study was designed to delineate possible inter-relations between activation and morphometric characteristics of vastus medialis muscle in competitive soccer players after a second ACL tear. METHODS: Twenty male soccer players (age: 29 (SD 6) years, 19 non-contact injury) were examined at the re-torn (R) and uninjured (C) sides before the revision surgery and 270-4,620 days after the first ACL injury. Patients performed isometric knee extension (KE) at 80% maximum voluntary torque for 33 seconds. Activity of the vastus medialis muscle was recorded using a surface array (Delsys). The signals were decomposed into individual motor unit (MU) action potentials. Only samples with at least ten correctly identified MUs were used for further analyses. MU action potential (AP) size of higher-threshold (> 20%) MUs served as outcome measures. Muscle biopsies were obtained at the end of the ACL revision surgery from the R side only. Samples were frozen in methylbutane, cooled in liquid nitrogen and mounted, cut with a cryostat and subsequently used for enzyme histochemical and cytophotometrical analyses. Differences between sides as well as linear relationships between muscle fiber morphology and MU activation were quantified using effect size (d) and Pearson's r statistics, respectively. RESULTS: On average, 121 muscle fibers per patient were analyzed (total: 2,423 fibers). Type I and II mean fiber diameter (I: 68 ĩm (13), II: 73 ĩm (14)) and fiber proportion (I: 40% (14), II: 60% (13), df = 19, $p < 0.01$, d = -0.8) differed significantly. The number of MUs recruited above 20% KE was on average lower at the injured side (R: 22 (9), C: 29 (8), df = 15, $p < 0.02$, d = -0.6). Nevertheless, no relevant differences for MUAP size could be proven between sides (R: 0.16 mV (0.10), C: 0.19 (0.16), df = 15, $p > 0.4$, d = -0.2). Body mass adjusted KE of R correlated with KE symmetry (r = 0.76, $p < 0.001$) and with MUAP size (r = 0.65, $p < 0.01$). MUAP size was inversely related to the fiber type diameter difference (r = -0.76, $p < 0.001$). CONCLUSION: The range in time since the first ACL injury can account for differential neuromuscular adaptations. However, patients with a greater KE symmetry performed better at their injured side. This supports the application of the limb symmetry concept. Moreover, a larger difference between fiber types (in favor of type II) probably assists neuromuscular compensations, even after a recurrent knee trauma.

## R1-2: Preliminary results on spatiotemporal and kinematic parameters after surgical intervention in patients with an equinovarus foot deformity following stroke

Eline van Staveren[1], Erik Prinsen[1], Jule Bessler[1], Leendert Schaake[1], Judith Fleuren[1], Elgun Zeegers[2], Rosemary Dubbeldam[1], Jaap Buurke[1], Hermie Hermens[1]
*[1]Roessingh Research and Development, [2]Medisch Spectrum Twente*

BACKGROUND AND AIM: Equinovarus is the most frequently (10-20 %) seen foot deformity in the affected leg after stroke [1],[2]. The equinovarus foot affects all phases of the gait cycle, initial contact occurs at other foot regions than the heel, during stance ankle stability and dorsiflexion reduces, and in swing phase the clearance is decreased. Consequently, this foot deformity severely compromises