MUSCLE STRENGTH AND NEUROMUSCULAR ADAPTATION

Prof. Per Aagaard

Preparatory activities:

Learning objectives (200 characters max): To obtain knowledge about the neuroplasticity and muscle adaptability with strength training and their importance for mechanical muscle function in sports and clinical rehabilitation.

Online Learning resources:

Video (web link):

Web resources (link):

Reading material:

Aagaard P, Bojsen-Møller J, Lundbye-Jensen J. Perspectives for progress in the assessment of neuroplasticity with strength training. Exerc Sports Sci Rev 48, 151-162, 2020

Aagaard P, Andersen JL, Dyhre-Poulsen P, Leffers AM, Wagner A, Magnusson SP, Halkjaer-Kristensen J, Simonsen EB. A mechanism for increased contractile strength of human pennate muscle in response to strength training: changes in muscle architecture. J Physiol 534, 613-623, 2001

Caserotti P, Aagaard P, Buttrup Larsen J, Puggaard L. Explosive heavy-resistance training in old and very old adults: changes in rapid muscle force, strength and power. Scand J Med Sci Sports 18, 773-782, 2008

Core activities:

Learning objectives (200 characters max):

Muscle strength assessment and testing: To (i) understand and decribe different measuring methods for the assessment of maximal concentric, eccentric and isometric muscle strength, power, and explosive muscle strength, and (ii) be able to design relevant testing paradigms in relation to specific types of exercise-based intervention and for specific clinical/non-clinical subject cohorts including athletes.

Neuromuscular adaptation in muscle and tendon in response to health-enhancing physical exercise: (i) to gain knowledge about the physiological adaptations in muscle morphology, muscle architecture, neural function, and tendon properties induced by resistance exercise, and (ii) to understand the mechanistic background of resistance exercise prescription.

Learning resources: Face-to-face classroom

Online learning resources

Lecturers' presentation (to be provided)

Reading material:

Aagaard P, Simonsen EB, Andersen JL, Magnusson P, Dyhre-Poulsen P. Increased rate of force development and neural drive of human skeletal muscle following resistance training. J Appl Physiol 93, 1318-1326, 2002

Del Vecchio A, Negro F, Holobar A, Casolo A, Folland JP, Felici F, Farina D. You are as fast as your motor neurons: speed of recruitment and maximal discharge of motor neurons determine the maximal rate of force development in humans. J Physiol 597, 2445-2456, 2019

Pearson SJ, Young A, Macaluso A, DeVito G, Nimmo MA, Cobbold M, Harridge SDR. Muscle function in elite master weightlifters. Med Sci Sports Exerc 34(7), 199–1206, 2002

Aagaard P, Simonsen EB, Andersen JL, Magnusson P, Dyhre-Poulsen P. Neural adaptation to resistance training: Changes in evoked V-wave and H-reflex responses. J. Appl. Physiol. 92, 2309-2318, 2002

Aagaard P. Training-induced changes in neural function. Exerc Sports Sci Reviews 31(2), 61-67, 2003

Kongsgaard M, Reitelseder S, Pedersen TG, Holm L, Aagaard P, Kjaer M, Magnusson SP. Region specific patellar tendon hypertrophy in humans following resistance training. Acta Physiol Scand 191, 111-121 2007

Kongsgaard M, Kovanen V, Aagaard P, Doessing S, Hansen P, Laursen AH, Kaldau NC, Kjaer M, Magnusson SP. Corticosteroid injections, eccentric decline squat training and heavyslow resistance training in patellar tendinopathy. Scand J Med Sci Sports 19, 790-802, 2009

Farup J, Rahbek SK, Vendelbo MH, Matzon A, Hindhede J, Bejder A, Ringgard S, Vissing K. Whey protein hydrolysate augments tendon and muscle hypertrophy independent of resistance exercise contraction mode. Scand J Med Sci Sports 24, 788–798, 2014

Van Cutsem M, Duchateau J, Hainaut K. Changes in single motor unit behaviour contribute to the increase in contraction speed after dynamic training in humans. J Physiol 513, 295-305, 1998

Video (web link):

Web resources (link):

- Aagaard et al., A mechanism for increased contractile strength of human pennate muscle in response to strength training: changes in muscle architecture. J Physiol 534.2, 613–623, 2001
- Aagaard et al., Increased rate of force development and neural drive of human skeletal muscle following resistance training. J Appl Physiol 93: 1318–1326, 2002.
- Aagaard P. Training-induced changes in neural function. Exerc Sports Sci Reviews 31(2), 61-67, 2003
- Aagaard P, Bojsen-Møller J, Lundbye-Jensen J. Perspectives for progress in the assessment of neuroplasticity with strength training. Exerc Sports Sci Rev 48, 151-162, 2020
- Kongsgaard et al., Region specific patellar tendon hypertrophy in humans following resistance training. Acta Physiol 2007, 191, 111–121
- Kongsgaard et al., Corticosteroid injections, eccentric decline squat training and heavy slow resistance training in patellar tendinopathy. Scand J Med Sci Sports 2009: 19: 790–802
- Del Vecchio A, Negro F, Holobar A, Casolo A, Folland JP, Felici F, Farina D. You are as fast as your motor neurons: speed of recruitment and maximal discharge of motor neurons determine the maximal rate of force development in humans. J Physiol 597, 2445-2456, 2019