The effect of neuromuscular electrical stimulation on human skeletal muscle

Johanna Fidlin*, 1, 3, 4 Stefan Reitner, 2 Eric Emanuelsson, 3, 4, 5 Carl-Johan Sundberg, 2
1 Department of Trauma, Acute Surgery and Orthopedics, Karolinska University Hospital, Sweden; 2 Department of Molecular Medicine and Surgery, Karolinska University Hospital, Sweden; 3, 4 Department of Physiology and Pharmacology, Karolinska Institutet, Sweden; 5 Department of Learning, Informatics, Management and Ethics, Karolinska Institutet, Sweden; 6 Department of Laboratory Medicine, Karolinska Institutet, Sweden

Introduction
Neuromuscular electrical stimulation (NMES) can be used to activate skeletal muscles and prevent atrophy during immobilization. However, the underlying acute transcriptional effects remains to be established. Thus, this study aimed to investigate how a single NMES-session, compared to a voluntary knee extension session (EX), influenced global mRNA-expression in the quadriceps muscle using newly developed textile electrodes integrated in pants.

Materials and Methods
In 30 healthy participants, gene expression in skeletal muscle biopsies from vastus lateralis was assessed with RNA-sequencing, before and 3 hours after a 30-minute session of NMES and/or EX. The NMES-intensity was set to 20% of each participant’s pre-tested maximal voluntary contraction (MVC), 200 (±79.7) Nm, corresponding to an acceptable level of discomfort (e.g. mean visual analogue scale (0-10) below 4). The EX-protocol was performed at 80% of 1-repetition maximum.

Results
NMES and EX triggered 4448 and 2571 differentially expressed genes (DEGs) respectively, with 80% of EX-response overlapping. Gene set enrichment analysis demonstrated many common pathways, and well-known exercise-genes, e.g. PARPGC1A, ABRA and VEGFA, were also up-regulated by NMES. However, some pathways were exclusive to NMES, e.g. peripheral nervous system development, or EX, e.g. muscle tissue proliferation.

Conclusion
A single NMES-session using the NMES-pants, applied with an acceptable level of discomfort at 20% of MVC, induced over 4000 DEGs largely overlapping with DEGs of EX, indicating that NMES to a large extent can produce similar molecular effects as EX. NMES can therefore potentially be an alternative for health benefits, especially in individuals not able to perform exercise.

TENDINOPATHY SEVERITY ASSESSMENT – ACHILLES (TENDINS-A): EVALUATION OF RELIABILITY AND VALIDITY IN ACCORDANCE WITH COSMIN RECOMMENDATIONS

Myles Murphy*, 1 Fergus McClean, 2 Dana Hince, 3 Ruth Chimenti, 2 Paola Chivers, 4 Turner Vosseller, 5 Sophia Nimphiou, 6, 7 Nonnathira Mukiambvi, 8 Peter Malliaras, 6 Nicola Moffull, 9 Robert-Jan De Vos, 10, 11 Ebong Rio, 11 Edith Cowan University, Australia; 1 The University of Notre Dame Australia, Australia; 2 University of Iowa, USA; 3 Jacksonville Orthopedic Institute, USA; 4 Northumbria University, UK; 5 Nelson Mandela University, South Africa; 6 Monash University, Australia; 7 University of Salerno, Italy; 8 Eumass MC University Medical Centre, The Netherlands; 9 A Trobe Sport and Exercise Medicine Research Centre, Australia

Introduction
We evaluated construct validity (structural validity and hypothesis-testing) and reliability (test-retest reliability, measurement error and internal consistency) of the new TENDINopathy Severity assessment-Achilles (TENDINS-A), which is the only outcome measure with adequate content validity for assessment of disability in Achilles tendinopathy.

Materials and Methods
Participants with Achilles tendinopathy completed an online survey: demographics, TENDINS-A, Foot and Ankle Outcome Score (FAOS) and Victorian Institute of Sport Assessment-Achilles (VISA-A). Exploratory factor analysis (EFA) evaluated dimensionality. Confirmatory Factor Analysis (CFA) evaluated structural validity. Correlations between TENDINS-A and the FAOS/VISA-A evaluated hypothesis-testing. Intraclass correlation co-efficient (ICC) represents test-retest reliability. Cronbach’s α represents internal consistency. Standard error of the measurement (SEM) represents measurement error.

Results
Seventy-nine participants (51% female) with a mean (SD) age= 42.6 (13.0) years, height= 175.0 (11.7) cm and body mass= 82.0 (19.1) kg were included. EFA identified three meaningful factors, proposed to be pain, symptoms and function. The best model identified using CFA had adequate structural validity (CFI= 0.959, SRMS=0.068), excluded three items from the original TENDINS-A and included three factors (Pain, Symptoms, and Function). The TENDINS-A exhibited moderate positive correlation with FAOS (rho=0.598, p<0.001), and moderate, negative correlation with VISA-A (r=−0.639, p<0.001). Reliability of the TENDINS-A is excellent (ICC=0.930; Cronbach’s α=0.808; SEM=6.54 units).

Conclusion
Our evaluation of the revised 10-item TENDINS-A has determined it has adequate validity and reliability. Thus, the TENDINS-A can be recommended for immediate use, being the preferred tool over all others to assess disability in Achilles tendinopathy.

REFERENCE DATA ON QUALITY OF LIFE AND FUNCTION IN PATIENTS WITH PATELLAR DISLOCATION AND TROCHLEAR DYSPLASIA: A NATIONAL COHORT STUDY

Niclas Haggaard Eystury*, 1 Hans-Christen Husted, 1 Lina H Ingelsrud, 1 Lars Blend, 1 Eriberg Mortensen, 2 Per Hölminck, 3 Kristoffer W Barford, 3 Department of Orthopaedic Surgery, The National Hospital of the Faroe Island, Faroe Island; 2 Sports Orthopaedic Research Center – Copenhagen (SORC-C), Department of Orthopedic Surgery, Copenhagen University Hospital Amager-Hvidovre, Denmark; 3 Interdisciplinary Orthopedics, Aalborg University Hospital, Denmark; 4 Clinical Orthopedic Research Hvidovre (CORH), Copenhagen University Hospital Amager-Hvidovre, Denmark; 5 Zealand University Hospital, Koge and Aleris Hospital, Denmark

Introduction
To investigate patient reported outcome measurement (PROM) reference data on a national cohort of patients between 15-19 years with prior patella dislocation and trochlear dysplasia.

Material and Methods
All inhabitants in the Faroe Islands between 15 to 19 years were invited to answer an online survey. The survey included questions concerning prior patellar dislocation and the PROMs: Banff Patella Instability Instrument (BPII), Kujala score, Marx score and the EQ-5D-5L. The survey included questions concerning prior patellar dislocation and the PROMs: Banff Patella Instability Instrument (BPII), Kujala score, Marx score and the EQ-5D-5L. Three cohorts were established: 1) The background cohort consisting of the participants with no prior patellar dislocation, 2) The patellar dislocation cohort consisting of all participants with prior patellar dislocation, 3) The trochlear dysplasia cohort consisting of all participants with prior trochlear dysplasia.