Berner
Fachhochschule

Abstracts der Master-Thesen 2022
Master of Science in Physiotherapie

▶ Gesundheit

Editorial

Mit Stolz dürfen wir Ihnen den Abstractband der diesjährigen Master-Thesen präsentieren.

Die aktuelle Evidenz praxistauglich und effizient zu kommunizieren, ist eine Herausforderung in der Physiotherapieforschung. Schmerzen und funktionelle Einschränkungen zu verringern sowie die Lebensqualität unserer Patient*innen zu verbessern, sind gemeinsame Ziele der Forschenden und Kliniker*innen. Leider bestehen seit jeher Lücken zwischen Forschung und Praxis, wofür gemäss diverser Autor*innen verschiedene Faktoren verantwortlich sind: mangelnde Kommunikation zwischen Wissenschaftler*innen und Praktiker*innen, unzureichende Finanzierung oder ein herausforderndes politisches Setting (Aaron JC, 2020; Beyer L, 2017; Mallonee et al. 2006).

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Damit Patient*innen von neu generierter Evidenz profitieren, muss diese alltagsnah und relevant für die klinische Praxis sein. Solche Forschungserkenntnisse erarbeiteten unsere Absolvent*innen in Form von qualitativ hochstehenden Master-Thesen verschiedener Designs, qualitativer und quantitativer Art. Oftmals werden die Arbeiten publiziert oder an Kongressen Praktiker*innen und Wissenschaftler*innen vorgestellt. Damit tragen die Master-Absolvent*innen in Physiotherapie massgeblich zur Verbesserung der Behandlungsqualität und der Entwicklung neuer Versorgungsmodelle bei.

Mit ihrem wissenschaftlichen und klinischen Fachwissen sind sie ein unverzichtbarer Teil des Gesundheitssystems und machen den Wissenstransfer aus der Forschung in die Praxis möglich.

Die Freude über die erfolgreichen Studienabschlüsse verbinden wir mit grossem Dank an unsere Dozierenden und Betreuenden, welche die Studierenden in ihrer Entwicklung tatkräftig unterstützt haben.

Den Master-Absolvent*innen gratulieren wir herzlich zu ihrer Diplomierung.

Prof. Dr. Amir Tal

Inhalt

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8 ## Development of the Lucerne Fall Risk Prediction Score for Inpatient Stroke Rehabilitation (L-PRESTO)

Abstract

Background: About 20% of stroke patients fall during inpatient rehabilitation, resulting in a prolonged rehabilitation stay. Stroke-specific fall risk factors are known, however, an appropriate fall risk assessment with high degree of diagnostic accuracy is lacking.
Objectives: The main aim was to determine the optimal cut-off value for the Lucerne ICF-based Multidisciplinary Observational Scale (LIMOS) at admission to inpatient rehabilitation for predicting the occurrence of at least one fall during inpatient rehabilitation in subacute stroke patients. The secondary aim was to perform the analysis for the subgroup of patients who walk at least with minimal support using the mini-Balance Evaluation System Test (mini-BESTest).
Methods: Single-centre, retrospective longitudinal cohort study from September 2019 to September 2021. Receiver operator characteristic analysis (ROC) with area under the curve (AUC), sensitivity, specificity, and positive (PPV) and negative predictive value (NPV) were used to assess the diagnostic accuracy of LIMOS and mini-BESTest predicting the occurrence of at least one fall.
Results: Of 327 patients (46% females), 50 (15%) patients experienced at least one fall during inpatient rehabilitation. Patients entered the rehabilitation after a median of eight days poststroke, and their median length of stay was 28 days. The optimal LIMOS cut-off value for predicting at least one fall during rehabilitation was ≥108/225 with an AUC of 0.803, sensitivity of 0.740, and specificity of 0.776. The PPV was 0.374, NPV 0.943. For the subgroup of walkers, the optimal mini-BESTest cut-off value was ≥13/28, with an AUC of 0.890, sensitivity of 0.714, and specificity of 0.730. The PPV was 0.119, and NPV 0.980.
Conclusion: LIMOS and mini-BESTest at admission to inpatient stroke rehabilitation were significantly associated with fall risk and show excellent performance at distinguishing between fallers and non-fallers. Both tests show excellent NPV, but a low PPV. Further research to externally validate these results is needed.

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Context of Injury Prevention Strategies in Swiss Basketball: Survey of Athletes, Medical Staff, and Coaches

Abstract

Objectives: This project aims at assessing opinions, attitudes, knowledge, practices, and perceived barriers and facilitators of injury prevention (IP) strategies in Swiss basketball teams.
Methods: An online survey was sent to athletes, coaches, and medical staff of the three best basketball leagues in Switzerland. The questionnaire was subdivided in four sections: (1) characteristics of participants, (2) knowledge, opinions, attitudes, and beliefs, (3) practices, and (4) barriers and facilitators.
Results: Among 105 persons who answered the questionnaire, more than 60% considered the risk of injury for basketball athletes as being high to very high. The ankle, knee, and the hand were considered as being the most at risk. More than 80% of participants considered that recovery, training load and the warm-up quality were very important factors for IP. More than 90% of participants considered IP as either important or very important with 53 (50.5%) of the participants indicating using exercise-based IP in their clubs. Athletes and coaches' motivation and compliance were judged as either important or very important for successful IP implementation by more than 80% of participants, with the coach being reported as the most influential person. Environmental barriers towards human or infrastructural resources were also reported as factors influencing IP strategies, namely be female participants.
Conclusion: Good knowledge and positive attitude towards IP were reported by participants, but exercise-based IP strategies lack implementation. The coach was considered as the most influential person and was reported with the athletes as playing an important role toward successful implementation.

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10 ## Responsiveness of the Start Back Screening Tool and the Örebro Musculoskeletal Pain Screening Questionnaire – A Systematic Review

Abstract

Background: Back pain is one of the most common causes of disability. Modifiable risk factors influence back pain recovery, and practice guidelines recommend including such factors into primary care management. Two worldwide used questionnaires to assess risk factors for persistent problems are the STarT Back Screening Tool (SBST) and the Örebro Musculoskeletal Pain Screening Questionnaire (OMPSQ). They could be used to assess patient evolution by replacing a battery of tests. The aim of the review is to know whether the two questionnaires are responsive to change.

Methods: A systematic review of the literature was conducted between September and December 2021 on various databases. Inclusion criteria were adults with back pain acute, subacute, or chronic stage, outcomes about responsiveness, including Area Under the ROC Curve (AUC), hypotheses about correlations and effect sizes.

Results: In total, thirteen studies were included, seven on the SBST and six on the OMPSQ. Part of the included studies directly investigated the responsiveness of the tools, while another part provided data relevant for statistical calculations. The small number of studies and their heterogeneity made it impossible to pool the data.

SBST appears to be responsive to distinguish improved from unchanged patients for global change and function (AUC: 0.75-0.83). In addition, it seems to have a moderate correlation with tools assessing global change and change in function, pain, and psychological dimension. Change in OMPSQ score presents a small to moderate correlation with global change, a moderate correlation with change in function, and a small correlation with pain change and change in psychological dimension.

Conclusion: The use of the SBST and the OMPSQ as outcome measures is possible even though this is not their primary purpose. However, further studies on the responsiveness of both tools are needed to confirm these initial results.

Keywords: Back pain; measurement properties; responsiveness; STarT Back Screening Tool; Orebro Musculoskeletal Pain Screen Questionnaire

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Assessing Balance Abilities in Healthy Adults on an Outdoor Fitness Trail

Abstract

Background: Fall events are a major factor of injuries in the European Union and are correlated with impaired balance abilities. It is suggested to clinically assess these abilities in prevention of fall events. Recent studies have investigated balance in a laboratory setting but their findings are not readily transferable into real-life scenario. Therefore, the aim of this study is to assess balance abilities of healthy adults on an outdoor fitness course.
Methods: 19 healthy adults grouped into two age-groups (18 – 30 years, n = 11; 50 – 70 years, n=8) were recruited through advertisements. After given informed consent subjects were instructed to walk through Zurich Vitaparcours© and execute eight different balance exercises. Pelvis movements were recorded by inertial measurement units and received acceleration was used to calculate smoothness and stability scores in two directions (medio-Lateral, anterior- posterior). Overall effects of age-group and exercise were statistically tested by different nonparametric rank-based methods. Further in-depth analysis was performed by Wilcox Ranksum-Group tests on every exercise, score, and direction.
Results: Most of the recruited subjects were female (68.4%) and already had experiences in training on Zurich Vitaparcours© (84.2%). No significant effects were found of age-groups in either score or direction. Exercises significantly affected both scores and directions. In-depth analysis showed no significant age-group differences in any exercise, score, or direction.
Discussion: Similarly, to recent literature, no age effects and age-group differences were found. However, some trends of smoother center of mass movements in more challenging balance and stabler center of mass in step-up-based activities by older participants can be assumed. This may indicate an underlying adaptation of balance strategies resulting, when preferred strategies will not compensate for the level of balance needed, in the facing challenge.
Conclusion: Present preliminary data give no conclusive results in assessing age relative balance abilities on an outdoor fitness trail. Trends and assumptions may indicate underlying adaption of movement behaviors in declining balance. Considering such strategies in assessing balance in an outdoor scenario may give better clinical indication about underlying balance issues. Further research is needed to confirm these trends and assumptions.

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12 Development of a Comprehensive Worksite Physical Activity Strategy for a Swiss Clinic and Exploring Its Costs and Benefits

Abstract

Background and Objectives: Physical inactivity (PIA) is a global pandemic with enormous health and economic consequences. Despite many advances in the understanding of the benefits of physical activity (PA), global levels of PIA remain high. Given the expanding evidence on the effectiveness of worksite interventions, it is time to apply this knowledge to a real-life context. Therefore, the objectives of this thesis were to develop a worksite PA strategy for employees of a Swiss clinic and exploring its potential impact.

Methods: In the first part of this thesis, a comprehensive worksite PA strategy was developed using the Intervention Mapping approach. In order to design an evidence based and feasible PA strategy, the circumstances of the clinic were considered together with data from the literature. Within the second part of this work, the potential costs and benefits of the worksite PA strategy were explored from an employer's perspective.

Results: The developed worksite PA strategy consisted of eight interventions designed to be delivered in a time range of one year. The interventions include educational training, health screening, periodic reminders, individual sessions, PA in the gym, group activities and a challenge month. The interventions aim at the individual, group or organizational level and rely on different theoretical behaviour change methods. The results of part II indicate that engaging employees of a Swiss clinic in a worksite PA strategy could help increase the activity level of the participants and thus influence company-relevant factors like absenteeism positively. The costs for the developed PA strategy were estimated to be CHF 142'636.88 and the implementation was assumed to lead to a positive effect on absenteeism (reduction in days = 381.35).

Conclusion: The societal burden associated with PIA is substantial and there is an urgent need for change. It is no longer a question of why to implement PA into every aspect of life but how. One option is to offer interventions at the workplace. This thesis presents a practicable worksite PA strategy for a Swiss clinic and can lay the groundwork for future intervention studies in the field.

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Exploring Neural Pathways After Lower Limb Amputation: A Pilot Study Using H-Reflex in Walking Under Different Weight Conditions

Abstract

Background: Control of motor variability involves peripheral reflex loops, supraspinal and cognitive resources. The extend of the influences of the different systems are diverse and underly the concept of adaptation. One tool to assess changes in reflex pathways is the Hoffmann Reflex (H-reflex). The aim of this study was to observe H-reflex amplitude in different walking conditions and to assess if different strategies of neural control on a spinal level can be seen depending on age and on lower limb amputation.

Methods: Ten healthy young (age 26.3 ± 4.7 years), 12 healthy elderly (age 62.5 ± 4.8) and four transfemoral or through knee amputees were included in the analysis. Five trials in different weight conditions (± 20% bodyweight, ± 40% bodyweight and 100% bodyweight) of six minutes each were conducted on a treadmill. H-reflex of the soleus muscle was measured during stance phase in the dominant for healthy or in the intact leg for amputees. A mixed factor repeated measures ANOVA model was used to analyze the effects of weight conditions on H-reflex gain. Soleus background EMG and M-wave amplitudes were added as covariates.

Results: An increase in H-reflex amplitude with increasing weight condition was observed in all groups. The impact of weight and of the weight and group interaction on H-reflex amplitude was statistically significant ($p < 0.0001$). The increase of H-reflex amplitude in young subject was the largest (+0.50mv). Amputees seemed to have higher amplitude sizes over all conditions and increase only happened between 80% and 120% bodyweight condition (+0.25mv) whereas elderly showed only minor increases over all conditions (+0.22mv).

Conclusion: The findings of this study indicate the presence of adaptation strategies on a spinal level to control motor variability. Although all groups seemed to involve more peripheral contribution under more loaded walking conditions, a trend to less modulation with age and after amputation and an overall higher H-reflex gain in amputees can be suggested. Further assessment of H-reflex in amputees might add new aspects in understanding motor control and neural reorganisation after lower limb amputation.

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14 Economic Evaluation of Three Home-Based Exercise Programmes to Prevent Falls in Older People From a Healthcare System Perspective

Abstract

Background: In 2019, 26% of the Swiss population over 65 years reported at least one fall in the last year. Costs due to elderly's falls in Switzerland per year amount to CHF 1.4 billion for material and CHF 6.6 billion for societal costs. A new home-based exercise programme was developed in Switzerland and evaluated in a three-armed randomised controlled trial. This current study aimed to perform the economic evaluation (cost-effectiveness and cost-utility) of these three home-based exercise programmes to prevent falls in older adults.

Methods: Economic evaluation was based on a RCT including 405 community-dwelling older adults. Their participation lasted one year. Evaluated home-based programmes were Test-and-Exercise (T&E), Otago Exercise Programme (OEP) and a leaflet of exercises. Intervention and direct medical costs of the programmes were evaluated from the healthcare system perspective. Costs were collected using trial monitoring data for the quantity. Costs per unit were collected through trial monitoring data and literature. Primary outcomes for the effects were fall rates and quality-adjusted life-years (QALY). Bootstrapping was used to assess uncertainty.

Results: Incremental falls after intervention were 0.293 (95% CI -0.613 to 0.003) falls more per person-year in T&E as compared to the leaflet. The ICER (-2,866.41) was interpreted as less effective and more expensive. Incremental falls after intervention were 0.291(-0.111 to 0.692) falls less per person-year in T&E than in OEP. The ICER (479.91) was interpreted as more effective and more expensive.

Incremental utilities were -0.076 QALY (95% CI -0.079 to -0.073) in comparison between T&E and the leaflet after the intervention. The ICUR (-13,847.48) was interpreted as less effective and more expensive. Incremental utilities were 0.025 QALY (95% CI -0.013 to 0.063) in the comparison between the T&E group and the OEP group after intervention. The ICUR (-2,100.78) was interpreted as less effective and more expensive.

Conclusions: No conclusion could be drawn about the cost-effectiveness of these three home-based programmes to prevent falls in older adults as (i) some implementation costs were not set at the moment of evaluation, (ii) RCT might be biased due to the lack of blinding and the high loss of follow-up rate.

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The Utility of the Physiotherapy Referral

Abstract

Introduction: In a context where the demand for health care is constantly increasing and a shortage of health care personnel cannot be ruled out, it is necessary to act and to target medical care as well as possible. Physicians and physiotherapists are bound by the compulsory prescription act for insurance coverage, in which the former must communicate a diagnosis, goals and means of treatment to the latter. However, the literature seems to show that a precise diagnosis appears on the prescription only in a minority of cases. It is therefore necessary to confirm these results, to better understand the issues related to prescribing, the workload that it generates and the relationship that the caregivers have with it.

Method: This study consists of two online surveys, one addressed to physiotherapists and the other to prescribing physicians practicing in Switzerland.

Results: The surveys received responses from 315 physiotherapists and 116 physicians. The data collected from physiotherapists indicated that only 46% of prescriptions contain a specific diagnosis with which they agree in 59% of cases. Physicians perform a medical examination in 87% of cases before referring patients to physiotherapists who are 83% to often or always perform an examination. Physiotherapists reported a lack of medical information about their patients in 65% of cases and 70% of them feel that this affects the quality of their care. Among the administrative time generated, the most mentioned reason is the prescription renewal. However, 81% of physicians remain attached to this system, particularly because of the patient follow-up it allows. Physiotherapists are 54% to consider that this devalues their profession but are simultaneously 40% to consider that it relieves them of identifying red flags and 39% to use it to confirm their diagnosis.

Conclusion: The results obtained highlight some of the advantages and disadvantages of the act of prescribing. It appears that physiotherapists may be able to take on more responsibility in certain situations and that this would require the development of skills in red flag identification and differential diagnosis.

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Performance Diagnostics in Lead Climbing: Development of a Test Battery for Upper Arm and Shoulder Strength

Abstract

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Purpose: To analyse the muscular, functional, and physiological requirements of lead climbers for upper arm and shoulder strength and to create a sport-specific test battery which has the highest possible correlation with climbers' redpoint (RP) level.

Methods: The first phase focused on an expert meeting to construct a test battery, based on the video analysis of the 2019 Climbing World Championships and an electromyography analysis of five male elite athletes. In the second phase, 43 healthy volunteers were included to complete the tests created. The outcomes were subjected to exploratory factor analysis and stepwise regression.

Results: Five tests were created. A three-factors model (power, strength endurance, maximal strength) explained 77% of the RP-level. For the factor power, the power slap dominant arm, the power slap non-dominant arm (PSND) and the muscle up explained the highest percentage of variation (adjusted $R^2=0.397$, $p<0.001$). For the factor strength endurance, it was the bent-arm hang and prone row (PR) (adjusted $R^2=0.336$, $p<0.001$) and for the factor maximum strength, it was the one-arm pull-up dominant arm (PUD) (adjusted $R^2=0.426$, $p<0.001$). The economical test battery was made up of the PSND, the PR and the PUD (adjusted $R^2=0.453$, $p<0.001$).

Conclusion: The Lead Climbing Upper Arm and Shoulder Strength Test provides a sport-specific performance diagnostic for shoulder power, maximal strength, and strength endurance. Athletes and coaches can select tests according to their needs and resources. A confirmatory factor analysis with more participants is needed to confirm the results.

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Analysis of Sensor-Based and Clinical Measures During Walking in Chronic Stroke Patients: A Cross-Sectional Study

Abstract

Background: Hemiplegic gait after stroke is characterized by gait asymmetry, a predictor of mobility impairments. Complementary to clinical assessments, kinematic gait analysis is needed for personalized rehabilitation aimed on increasing mobility of stroke survivors. Sensor-based gait analysis systems could be a possible tool for kinematic gait analysis in chronic stroke patients. The aim is to investigate the ability of wearable sensors to differentiate between hemiplegic and less affected leg in chronic stroke patients and relate the kinematic parameters obtained through sensors with clinical assessments used for gait ability analysis.

Methods: This cross-sectional study included chronic stroke patients able to walk minimum for ten meters. Kinematic measurements were taken using a wearable motion sensing system while performing the Six-Minute-Walk Test (6MinWT). Kinematic measurements included swing and stance phase durations, double and single support phase durations, step and stride length, walking speed, cadence, ranges of motion (ROM) of hip, knee and ankle. Analysis of differences in the kinematic parameters of both lower extremities was done using paired t-tests. Correlation analysis between kinematic parameters of the hemiplegic leg and outcomes of clinical tests 6MinWT, Motricity Index (MI), Ten-Meter-Walk Test (10MWT), Timed-Up-and-Go Test (TUG) and International Physical Activity Questionnaire (IPAQ), was conducted using Pearson Correlation Coefficient.

Results: Twenty-eight subjects (mean age 62 years; M/F 19/9; walking aid/none 9/19; foot orthosis/none 4/24) were tested and analysed. Swing and stance phase durations, single support phase duration, ROM of knee and hip flexion showed significant differences ($p < .05$) between both lower extremities. Kinematic parameters that correlated the strongest with 6MinWT, MI, 10MWT and TUG were double support phase duration, stance phase duration, step and stride length, ROM of hip flexion.

Conclusion: The wearable motion sensing system can detect differences between the lower extremities of chronic stroke patients for many kinematic parameters tested. Double support phase duration, stance phase duration, step and stride length, ROM of hip flexion of the hemiplegic leg are important parameters for quantifying gait impairments. Sensor-based gait analysis systems are useful and valid tools to assess impairments in walking ability of chronic stroke patients in clinical settings. These might optimize rehabilitation and clinical decision making.

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18 Sex Differences in Falls Among the Elderly Community-Dwelling Swiss Population: A Population-Based Cross-Sectional Survey

Abstract

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Background: Falling can be a serious health risk, especially for older people, and in addition to the immediate traumatic injuries, it is also associated with a risk of secondary diseases and disease progression. Although differences in the prevalence of falls between men and women have been described in the literature, a causal explanation for this finding is still lacking.
Methods: To address this research gap, the data from the Swiss Health Interview Survey 2017 were used to determine which risk factors for falls in general, and specifically for sex, can be determined using socio-demographic, biological and behavioral covariates within the framework of univariable and multivariable regression models.
Results: Regarding the incidence of falls, it was found for men and women that the one-year incidence proportion of falls increases every 10 years among 60-year-olds (men: 21.7%, 24.0%, 29.0%; women: 20.3%, 26.5%, 36.0% [both p < .018]) and differs clearly by level of functional limitation (both p < .005). However, older age was associated with a disproportionately higher incidence proportion of falls in women. In the case of diseases, osteoarthritis and urinary incontinence in specific are associated with the risk of falls. Other correlations, such as possible nicotine abuse, do not show up consistently across all calculated regression models, so that findings related to these correlations are difficult to interpret.
Conclusion: Taken together, the data presented here also indicate that women fall more frequently in old age than men, but no factor can be identified as a single causal factor itself. In the sense of the frailty concept, a multi-causal genesis of falls can therefore be concluded, the mechanisms of which possibly have a stronger effect in women than in men. Further studies are necessary to clarify this, especially concerning to the presumably multi-causal genesis of falls in the elderly.

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«That Is Just a Completely Different Kind of Goal» Palliative Care in Physiotherapy: Ethical Aspects

Abstract

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Background: Due to current demographic developments, the growing prevalence of non-communicable diseases and advances in medical technology, palliative care has been receiving increasing attention from healthcare professionals. Long periods of illness, frailty and multimorbidity lead to novel challenges in the health care field, which will need to be addressed by evaluating the current training curriculum for physical therapists. The care of palliative patients and the end-of-life setting are perceived to be emotionally and mentally challenging by healthcare professionals. Therefore, the purpose of this study is to conduct a survey among physical therapists in Switzerland on their perception of palliative care and the challenges they are facing. Based on the insights derived from these interviews, conclusions are drawn with regards to ethical aspects.

Methods: The qualitative research was conducted by means of six semi-structured interviews with physical therapists in Switzerland. None of them had completed any specialized or continuing education courses in palliative care. Their existing knowledge originated from their Bachelor of Science professional curricula as well as practical work experience gained during their employment in an acute care hospital, rehabilitation centre or out-patient-clinic. The analysis of the interviews was carried out following an interpretative phenomenological approach and the study was conducted according to ethical codes of practice.

Results: Five female and one male physical therapist with one to nine years of professional experience spoke about their perceptions. In those conversations, the following recurring themes emerged: The Professional Role, The Palliative Care Patient, Complex Situations, Communication and Responsibility, Strategies, Physical Therapy Curriculum, Ethical Dimensions and Different Wards. These eight themes and their sub-categories were discussed focusing on three main areas and related concepts: «Complexity as a Challenge« (Moral Distress), «Humanistic Approach» (Physio Humanities) and «A Broader View of the Physiotherapists' Professional Role» (Rehabilitation Light). These three areas proved to be highly interdependent within the field of palliative care.

Conclusion: Managing ethical aspects and dealing with challenging situations are topics that should be integrated into the physical therapists' training curriculum in both a longitudinal and inter-professional manner.

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Immediate Effects of Pharmacological Neuromodulation on Gait Biomechanics in Patients With Chronic Spinal Cord Injury Treated With Epidural Electrical Stimulation: A Randomized, Double-Blinded, Placebo-Controlled Study

Abstract

Introduction: By Spinal Cord Injury (SCI) patients with a high lesion only the excitatory input is missing to operate the lumbosacral interneuron circuit. Epidural electrical stimulation (EES) is a technology that can compensate this lack of excitation. This allows a new form of gait rehabilitation. In physiology, dopamine and serotonin, two neurotransmitters, activate spinal neural networks. Levodopa/Carbidopa and Buspirone are drugs that contain these neurotransmitters. The question is whether gait speed and EMG activity can be improved with these active drugs by combining them with targeted EES (tEES).
Methodology: Four conditions were randomly tested: Levodopa/Carbidopa, Buspirone, the combination Levodopa/Carbidopa and Buspirone and placebo. To monitor the effects of these different substances, the following tests were carried out: lower extremity motor score (LEMS) and 10-meters walk test with recording of electromyogram(EMG) and kinematic activity at a selected and fast speed with and without tEES. The tests are performed 1 hour before drug administration and then at 30 min, 90 min and 150 min after drug administration. One patient who received tEES therapy completed the research protocol. A two-way ANOVA was performed to define under which conditions the walking speed is influenced by the drug and the pharmacokinetics. Then LEMS, EMG and spatiotemporal data were observed to find a link with speed variations.
Results: The results have to be taken carefully because the study is still blinded. Drugs tend to slow down gait. The differences in speed are explained by drugs and pharmacokinetics especially when the patient is walking fast. The EMG activity varies with a tendency to decrease muscle activity on the vastus lateralis.
Conclusion: The data interpretation turns out to be difficult as the results are still blinded due to the pending enrolment of the last patient. However, this first analysis seems to show that there may be a dyssynergy between the drugs and tEES. In addition, the patient had numerous anticipated adverse events. Further studies are needed to investigate different dosage and customization of dosing for each patient as well as to investigate modulation of tEES to favor a synergy of action between the tEES and the drug.

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Force Measurement of Knee Extensor and Flexor Using a Fixed Handheld Dynamometer: A Reliability and Validity Study

Abstract

Objectives: There are different methods to measure the force of the knee extensor and flexor with a handheld dynamometer (HHD). This study aims to analyse the intra- and interrater reliability of a new isometric force measuring technique for the knee extensor and flexor with a fixed HHD.

Design: Within a cross sectional study design the intra- and intertester reliability and validity is analyzed.

Setting: University laboratory

Participants: Twenty-five healthy, young participants were assessed.

Main Outcome Measures: Peak force of knee extensor and flexor were measured three times with an HHD (Hoggan microFET2) and ones with a force device of Bern Movement Laboratory. Statistical analyses to calculate the intra- and intertester reliability comprised intraclass correlation coefficients (ICC), Standard error of measurement and minimal de¬tectable change. Validity calculation included Bland-Altman analysis and Pearson correlation.

Results: ICC for Intra- and interrater reliability of knee extensor and flexor are good to excellent. The Bland-Altman analysis demonstrates a relatively high mean bias for knee extensor and flexor.

Conclusion: The fixed HHD to measure the force of knee extensor and flexor is a reliable tool. When comparing it to the force device of Bern Movement Laboratory there is a significant bias between the two techniques.

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Measurement Properties of the «Quality First» Assessment to Evaluate Movement Quality in Hop Tests Following ACL Rehabilitation – A Cross-Sectional Study

Abstract

Background: Current approaches fail to adequately identify sport readiness after anterior cruciate ligament (ACL) rehabilitation. Altered landing biomechanics after ACL reconstruction are associated with increased risk of a non-contact ACL re-injury. There is a lack of objective factors to screen for deficient movement patterns. Therefore, the aim of this study was to investigate content validity, interpretability, and internal consistency for the newly developed «Quality First» assessment to evaluate movement quality during hop tests in patients after ACL rehabilitation.

Method: Participants in this cross-sectional study were recruited in collaboration with the Altius Swiss Sportmed Center in Rheinfelden, Switzerland. After a successful ACL reconstruction, the movement quality of 50 hop test batteries was evaluated between 6 and 24 months postoperatively with the «Quality First» assessment. Content validity was assessed from the perspective of professionals. To check the interpretability, classical test theory (CTT) was employed. The Cronbach's α was calculated to evaluate internal consistency.

Results: Content validity resulted in the inclusion of three different hop tests (single leg hop for distance (SLHD), vertical hop (VH), side hop (SH)). The «Quality First» assessment is enabled to evaluate movement quality in the sagittal, vertical and the transversal plane. After the exclusion process, the «Quality First» assessment was free from floor and ceiling effects and obtained a sufficient Cronbach's α. The final version consists of 15 items, rated on a 4-point scale.

Conclusion: By means of further validations, the «Quality First» assessment could offer a possibility to evaluate movement quality after ACL rehabilitation during hop tests.

Keywords: Anterior Cruciate Ligament, Return to Sport, Movement Quality, Assessment, Hop Test, Measurement Properties

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External Validation of a Prediction Model for Independent Gait After Stroke

Abstract

Introduction: Stroke is one of the most common chronic diseases in adults. 65% of stroke patients are initially non-ambulatory after stroke. One model to predict independent gait after stroke is Veerbeek et al. (2011), which was developed with 154 patients. In the study, the logistic regression analysis for a total of 19 factors showed that with MI lower limb and TCT sitting within 72 hours after stroke, there was a probability of 0.98 to walk independently after 6 months post-stroke. In this Master Thesis the prediction model of Veerbeek et al. (2011) was tested within a new cohort.

Method: This prospective evaluation study was performed in the KSW. To externally validate the prediction model of Veerbeek et al. (2011) the TCT and the MI were tested at baseline for each individual participant, then the FAC after three months at a follow-up. The calculation of the Veerbeek model was reproduced and analysed in subgroups to investigate the heterogeneity of the new cohort.

Results: 50 full datasets of participants were analysed. 66% of the participants did walk independently after three months. The maximum probability to regain independent gait was at 73.6% with the new model. The maximum probability to regain independent gait for the subgroup of LACI, PACI and TACI was at 76%. For the subgroup (n=19) the localisation of POCI was at 72.7%.

Discussion: The validation of the model of Veerbeek et al. (2011) has shown a more pessimistic probability of 73.6% for participants to walk independently with two positive predictors. The maximum probability to regain gait for the LACI, TACI, PACI subgroup was at 76.0% the minimal probability was vanishingly small. In the POCI subgroup the maximum probability to regain gait was at 72.7%. A big difference was found in the baseline of the values of the MI and in the localisations of the lesion. A limitation of this study is the small number of participants and the small number of events.

Conclusion: The validation of the Veerbeek et al. (2011) model was at a lower probability to regain gait and had a more pessimistic outcome of the prediction values.

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24 Effect of Wearing Posture Shirts on Self-Reported Neck/Shoulder Complaints in Office Workers: A Randomised Clinical Pilot Trial

Abstract

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Background: Neck and shoulder complaints are common among office workers. Different treatment options are described in the literature. New technologies such as posture-enhancing shirts are now freely available on the market, but there is no clear scientific evidence for their efficacy.

Objective: This pilot study aims to evaluate if posture-enhancing shirts can have a positive effect on self-reported shoulder/neck complaints in the workplace for the wearer.

Methods: This randomised clinical pilot trial included 47 Swiss office workers suffering from shoulder/neck complaints. The study was conducted from January 2021 until July 2021. Participants were randomly assigned to the two groups (one wearing a posture shirt, the other one wearing a regular functional shirt). The German version of the Neck Disability Index (NDI) was used to operationalize the change of subjective complaints. Wearing time and information about pain were recorded as monitoring. Outcomes and all other data were collected by online questionnaires. The outcomes were recorded at baseline, after two and after four weeks of wearing the shirts. The analysis was done in the framework of parametric testing. Between- group comparisons were tested with a one-way ANOVA (alpha = 0.05).

Results: An improvement regarding the disability was found in both groups (intervention: -3.53 / control: -3.56 points in total NDI score). There were no significant differences found between the groups regarding the total NDI score.

Conclusion: Wearing a posture shirt may have a positive effect on pain and disability in office workers with mild neck complaints without negative side effects like discomfort.

Keywords: posture, neck pain, office workers, posture shirts, Neck Disability Index

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An Augmented Reality Obstacle Course for Stroke Subjects – A Usability Study

Abstract

Background: Globally, the number of stroke subjects steadily increases and with it the demand for effective rehabilitation to reduce long-term disabilities such as gait impairments. However, due to limited resources in the health care system, effective, unsupervised, adjunct training is needed. To provide such training, the «Augmented Reality for gait Impairment after Stroke» (ARISE) system has been developed. So far, little is known about its usability in the context of stroke rehabilitation. To address this and gain information for the further development process, a usability study with focus on user-experience was executed.
Methods: The study was designed as a single session usability study. Fifteen stroke subjects in the chronic phase were included. Participants were asked to prepare the system, complete an Augmented Reality (AR) obstacle course, then turn off and restore the system. The primary outcome was the System Usability Scale (SUS). As secondary outcomes, the Post Study System Usability Questionnaire (PSSUQ), the Virtual Reality Symptom Questionnaire (VRSQ), observations during the tasks and a semi-structured interview were conducted.
Results: All participants were able to use the ARISE system and to perform the obstacle course. In the SUS an overall mean score of 81.83 with a standard deviation of ±12.69, was found. This corresponds to a rating as «good to excellent». Symptoms reported in the VRSQ were rated as slight and moderate, none as severe in intensity. No adverse events which were not asked for in the VRSQ occurred. Various difficulties and suggestions for improvement were identified from the feedback received from the participants.
Conclusion: Overall, the users were satisfied with the usability of the system. As several difficulties with the hard- and software were detected and virtual reality symptoms occurred, further adjustments to the system are necessary. This study provides user-based indications for the development of augmented reality systems.

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Physical Activity Based on Daily Step-Count in Inpatient Setting in Stroke and Traumatic Brain Injury Patients in Subacute Stage: A Cross-Sectional Observational Study

Abstract

Background: In neurorehabilitation, improving walking ability is one of the most important goals. It's important to measure daily step-count to evaluate level of activity and proportion of patients to influence neuroplasticity and function.
Objective: Evaluate daily step-count in subacute patients following traumatic brain injury and stroke in inpatient neurorehabilitation setting and comparison to recommended stepcount.
Methods: A cross-sectional observational study with 30 participants. Evaluation of daily step-count over a seven-day period, measured by StepWatch™ ankle sensor. Steps were analyzed based on walking ability measured with the Functional Ambulation Categories. Variation in step-count was compared to the daily schedule and therapy-plan. Correlations between steps taken and gait function, walking speed, light touch, joint position sense, cognition, and fear of falling were calculated.
Results: Median(IQR) number of daily steps was 2512(568.5,4070.5) over all participants. Participants not able to walk independently took 336(5-705), participants able to walk with therapy assistance took 700(31-3080), significant deviation from recommended value (p=0.002), independent walkers took 4093(2327-5868) daily steps, significant deviation from recommended value (p=<0.001).
Conclusions: 10% of participants reached the recommended number of steps regardless of walking ability. The better the walking ability, the more steps were taken. Further research should evaluation strategies to increase daily step-count.

Keywords: Neurorehabilitation, Monitoring, Gait, Daily steps, Step-count, Stroke, Traumatic brain injury

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The Effect of a Night Splint for Plantar Heel Pain on Pain, Function and Quality of Life: A Randomised Controlled Pilot Study

Abstract

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Background: Plantar heel pain (PHP) is a common musculoskeletal condition that affects the foot. There is good evidence that foot orthoses may help to reduce PHP symptoms. Some studies have reported that the additive therapy with night splints (NS) produces better results, but the sample sizes have been quite small. Larger randomised controlled trials (RCTs) are needed to prove the effect of NS. The aim of this pilot study was, on the one hand, to check the feasibility of such an RCT and, on the other hand, to investigate the effect of additive therapy with the NS Dorsallift® on PHP symptoms.
Methods: In this randomised controlled pilot study, eligible participants were randomly distributed into two groups. Both groups received foot orthoses, and the intervention group also received a NS (Dorsallift®), which was used for eight weeks. The Foot Function Index and the 12-item Short Form survey were used to measure the primary and secondary outcomes, respectively. Both outcomes were analysed with a two-sample t-test. The study's feasibility was assessed using four criteria: adherence, attrition rate, safety and acceptability.
Results: Twenty-one participants participated and were included in the analysis. The feasibility criteria showed a high adherence (90.5%), with no adverse events recorded. Regarding primary and secondary outcomes, there were no statistically significant differences between the two groups. However, there were significant differences within the groups in every measurement, except for the mental component summary score of the Short Form 12 questionnaire.
Conclusion: This study proved the feasibility of an RCT investigating additional therapy with a NS and demonstrated this may have a clinically relevant benefit regarding pain management and function in patients with PHP. However, the effects are too small to be statistically significant.

Keywords: Plantar heel pain, Plantar fasciitis, Night splint, Foot orthosis, FFI, SF-12

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28 Relation Between Plantar Pressure and Navicular Movement in Healthy Adults and Patients With Knee and Foot Problems During Gait

Abstract

Background: Plantar pressure distribution and foot posture are the most clinically used diagnostic tools, but they are not able to give a statement about dynamic foot function. The navicular movement is a key factor to determine excessive foot pronation and an important clinical indicator to represent foot function in dynamics. An exploratory cross-sectional study was conducted aiming to determine the relation between plantar pressure and navicular movement in healthy adults and patients with knee and foot problems during gait.

Methods: Total 46 participants were measured during walking and running on a treadmill. Navicular motion from a four-marker foot model was divided into complaint groups and investigated with kinetic parameters using multiple linear regression analysis.

Results: Significant peak pressure and maximum force changes in relation to navicular drift were observed in hindfoot and midfoot. Navicular drift increased with decreasing peak pressure ($p = 0.007$) and maximum force in midfoot ($p = 0.001$), as well as with increasing peak pressure ($p = <0.001$) and maximum force ($p = <0.001$) in hindfoot during running. Navicular drop couldn't explain any significant correlation with peak pressure and maximum force. There wasn't a significantly correlation in COP shift with navicular drop and navicular drift during running, as well as during walking there were no relevant relation between kinematics and all kinetic variables.

Conclusion: It might be a relevant relation between navicular drift with peak pressure and maximum force in midfoot and hindfoot during running. A close correlation between kinetic and kinematic data across the whole foot couldn't be definitively confirmed in this study.

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Reliability of the «Quality First» Assessment in Hop Tests Following Anterior Cruciate Ligament Injury: A Cross-Sectional Study

Abstract

Background: Determining when it is safe to return to sports is a difficult challenge. Currently, there are no standardised guidelines for return to sport after anterior cruciate ligament (ACL) reconstruction. Hop tests with various jump landings are often used for the evaluation of functional performance. There does not appear to be an adequate instrument to assess movement quality in hop tests. Therefore, the aim of this study was to develop a time- and cost-efficient instrument to assess movement quality in hop tests. This study evaluated whether the «Quality First» assessment through a real-time video analysis is reliable.

Methods: 34 subjects (mean age 24.2 ±8.2) were included in this cross-sectional study. 50 videotapes of each type of hop test (vertical, single-leg for distance, side) were included. The intra- and interrater reliability and the difference between slow-motion and real-time analysis were evaluated. Inter- and intrarater reliability were calculated using the intraclass correlation coefficient (ICC2 / ICC3). In addition, the standard error of measurement (SEM) and the minimal detectable change (MDC) were calculated. A Bland-Altman analysis was performed to assess the difference between the two measurement methods.

Results: Interrater reliability (ICC2) for «Quality First» assessment in real-time ranged from 0.21 to 0.36, with SEM ranging from 1.48 to 1.9 and MDC ranging from 4.09 to 5.26. Intrarater reliability (ICC3) ranged from 0.74 to 0.86, with SEM ranging from 1.01 to 1.35 and MDC from 2.81 to 3.74. The Bland-Altman analysis showed a significant mean bias of 0.8 points between real-time and slow-motion for the vertical hop. No systematic mean differences were calculated for the other hop tests.

Conclusion: The «Quality First» assessment performed in real-time by one and the same therapist, could be a reliable and time-efficient tool. However, the interrater reliability for this instrument is poor. A Bland-Altman analysis of the two methods showed a slight, systematic overestimation of the total score in real-time for the vertical hop. Therefore, the «Quality First» real-time assessment can be used in clinical work for monitoring of individual patient progress.

Keywords: Anterior Cruciate Ligament, Hop Test, Movement Quality, Real-time, Return to Sport, Reliability

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30 Does Spinal Movement Mediate the Relation Between Pain and Disability in Low Back Pain? A Systematic Review and Meta-Analysis

Abstract

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This meta-analysis examined if spinal amplitude is associated with the degree of disability and pain intensity in patients with low back pain (LBP) and if spinal amplitude mediated the disability-pain relation. Thirty cross-sectional and 55 longitudinal studies (7428 participants) were included. The pooled correlation coefficients [95% confidence interval] of cross-sectional data were -0.23 [-0.29 to -0.18] and -0.15 [-0.20 to -0.10] for the relations between spinal amplitude and degree of disability, and pain intensity, respectively. For the longitudinal data, correlation coefficients were -0.15 [-0.26 to -0.03] and -0.26 [-0.34 to -0.18] for the spinal amplitude - degree of disability and for the spinal amplitude - pain intensity relations, respectively. Thus, low spinal amplitude was weakly associated with high degree of disability and high pain intensity. Gain in spinal amplitude was weakly associated with reduction in degree of disability and pain intensity. Subgroup analyses showed quite similar results and highlighted that flexion is the most tested movement. Spinal amplitude did not mediate the relation between pain intensity and degree of disability with correlation coefficient of 0.03 [0.29 to 0.43] and 0.01 [-0.02 to -0.04] for cross-sectional and longitudinal data analysis, respectively. The very small effect sizes found in this meta-analysis forces researchers and clinicians alike to reconsider the role of spinal amplitude with respect to the degree of disability and pain intensity over time in patients with LBP, and suggested the involvement of other determining factors in these relations.

Keywords: Spinal kinematics, disability, pain intensity

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Motor Imagery and Action Observation on Motor Learning in Healthy Individuals and Patients: A Systematic Review and Meta-Analysis

Abstract

Introduction: New research showed that the combined intervention of Action Observation (AO) and Motor Imagery (MI) activates more brain areas than AO or MI alone. Our systematic review evaluated the effect of the combined intervention of AOMI on motor learning in healthy individuals and patients.

Methods: A systematic search strategy was applied to Cochrane Library, Embase, Medline Ovid, Physiotherapy Evidence database (PEDro), PsycINFO, Scopus, SPORTDiscus, Web of Science and the clinicaltrials database. The screening processes and data extraction were performed by two independent authors. Risk of Bias and GRADE assessment were conducted for the methodological quality of the studies.

Results: From 5440 identified references, 22 randomized controlled trials were included after the screening steps (total 869 participants: healthy individuals, Parkinson's disease, patients after a stroke, patients after a total hip arthroplasty, children and students with neurological impairments). An overall forest plot was created. Included studies differed greatly in intervention, participants, and outcomes. Therefore, only four studies were included in three meta-analyses (dart throwing performance and ball rotation performance (completion time and error-rate)) to examine the effect of AOMI on motor learning. In most studies the first-person perspective was used for AO and MI and the kinesthetic mode for MI. Number of AOMI sessions ranged from one to 126, three to 630 total AOMI trials, and the intervention duration ranged from one day to eight weeks. The RoB score varies from low to high and the GRADE score is low.

Discussion: The systematic review shows a positive effect of AO combined with MI on motor learning. So far, no final conclusion can be drawn to on essential parameters (simultaneous or alternating AOMI, mode, perspective, number of trainings, intervention duration) of an AOMI intervention due to the high heterogeneity of the studies.

Keywords: Action Observation, Motor Imagery, Motor Learning, Randomized Controlled Trial

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32 Early Rehabilitation Interventions in Critically Ill Adults With COVID-19 – A Retrospective Cohort Study

Abstract

Objective: The aim of this retrospective observational study was to report early rehabilitation interventions in critically ill patients with COVID-19 treated in a mixed, academic intensive care unit (ICU) in Switzerland and to draw comparisons between non-severe and severe COVID-19 subgroups, classified according to the oxygenation index. Methods: Adults admitted to the ICU with a laboratory confirmed SARS-CoV2 infection were included. Patients were divided into non-severe or severe COVID-19 by their oxygenation index (lowest within first 24 hours). Routine data was collected by physicians, nurses and therapists including ICU treatment, physical therapy sessions and mobilization levels.

Results: We analyzed 246 patients, whereby 103 (42%) were classified as non-severe COVID-19 and 99 (40%) as severe COVID-19. Oxygenation index was missing for 44 (18%) patients. Rehabilitation interventions did not differ between subgroups. But patients with non-severe COVID-19 reached higher mobilization levels at ICU discharge (median level 5 'edge-of-bed' [IQR 3-6] versus 3 'side-edge' [0-6], p=0.005). Median time to the first edge-of-bed mobilization was 1.99 days [IQR 0.5-7.6]. Although, patients with non-severe COVID-19 sat on the edge-of-bed significantly earlier than patients with severe COVID-19 (median 2.2 days [IQR 0.7-5.3]) versus 7.2 [2.7-12.1]; p=0.019).

Conclusions: Early rehabilitation in critically ill adults with COVID-19 can be started within 48 hours of admission. However, compared to non-severe COVID-19, time to first edge-of-bed mobilization was delayed in patients with severe COVID-19. Physical therapy service extension, daily screening, interprofessional management and a culture of early mobility may have contributed to the sustained early mobilization practice even during pandemic peaks.

Impact Statement: Early ICU rehabilitation is feasible in critically ill patients with COVID-19 and can be implemented with existing protocols. Screening based on oxygenation index might reveal patients at risk and increased need for physical therapy.

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Neuromechanical Analysis of Selected Corrective Exercise Therapy Approaches in Adolescent Idiopathic Scoliosis

Abstract

Purpose: The purpose of some physiotherapeutic methods for the treatment of adolescent idiopathic scoliosis (AIS) is to minimize curvature and strengthen trunk muscles but what is happening regarding spinal posture and muscle activation during exercises execution remains poorly documented. Therefore, the aim of the current study was to investigate paraspinal electromyographic (EMG) activity and frontal plane curvature angle in patients with AIS performing Schroth, Gyrotonic, and Plank exercises and determine whether they responded as expected.

Methods: Frontal plane curvature angles and paraspinal EMG activity were measured using skin markers and bipolar surface electrodes placed on either side of the curves at the apex, upper and lower end vertebra level respectively. Seven young patients with single thoracic or thoracolumbar curve with right-sided convexity performed various tasks as Schroth, Gyrotonic and Plank exercises as well as a reference position.

Results: Paraspinal muscles were more active on the convex side than on the concave during all tasks performed but the paraspinal EMG activity was higher during the reference positions than during the exercises. Frontal plane curvature angles and EMG ratios remained similar during all tasks.

Conclusion: The current study confirms the expected muscles imbalance between sides of the curve but the Schroth, Gyrotonic and Plank exercises did not seem to allow any improvement in patients spinal posture and EMG ratio during their executions. Therefore, improvement of those physiotherapeutic exercises should be considered.

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34 Anterior Cruciate Ligament Reconstruction From Pre-operative Rehabilitation to Return to Sport: A Survey in Swiss Physiotherapists

Abstract

Objectives: This study investigated the current clinical practice of Swiss physiotherapists when treating patients with anterior cruciate ligament reconstruction (ACLR) from pre-operative rehabilitation until return to sport (RTS). We assessed self-reported optimisation strategies and barriers to practice, and evaluated whether there was a relevant difference in clinical practice for physiotherapists who had post-graduate certification in sports physiotherapy or deep clinical experience.

Design: Cross-sectional survey

Setting: Online survey platform

Participants: Swiss physiotherapists

Main Outcome Measures: The survey comprised six sections: participant information, pre-operative rehabilitation, post-operative rehabilitation, RTS, injury prevention, and self-reported optimisation strategies and barriers.

Results: Variability was observed in the clinical practice, with some differences in subgroups. A minority treated patients pre-operatively. Overall, 91% included quadriceps open kinetic chain exercise, 37% used patient-reported outcomes measures (PROMs) and 39.3% considered psychological criteria for RTS. Overall, 67.2% felt that their practice was limited and reported wide changes needed and barriers.

Conclusion: The minority of physiotherapists treating patients preoperatively, using PROMs, or considering psychological criteria for RTS suggest that clinical practice should be improved, and underlines the necessity for a better understanding of barriers hindering implementation of the best evidence, and the importance of redefining the clinical process around ACLR rehabilitation in Switzerland.

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Epidemiology and Costs of Injury in CrossFit® Participants in Switzerland

Abstract

Background: CrossFit® is an exercise program, that has gained attention for its focus on functional movements that are ballistically executed. The high levels of fatigue, difficulty of the movements and competitive nature of the program may lead to the conclusion that CrossFit® is dangerous (Friedman et al., 2015; Joondeph & Joondeph, 2013). This study aimed to establish injury rates and patterns for CrossFit® participants in Switzerland, based on athlete-reported information from an online-survey and further investigations regarding possible correlations between injuries and person and/or training related variables as well as to assess direct and indirect costs of injury during training or competition.

Methods: Data was collected retrospectively via an electronic survey from February to July 2021. The survey was designed based on previous work on participation in CrossFit® and injury epidemiology (Mehrab et al., 2017). Included were male and female athletes aged 18 years and older training at a CrossFit® gym in Switzerland. Data were analyzed using frequency analysis and descriptive statistical methods. Logistic regressions and univariate analyses were used to estimate the odds ratios (OR's) for each variable for obtaining an injury. For all statistical tests, $P < .05$ is considered statistically significant.

Results: A total of 325 out of 438 participants met the inclusion criteria. The prevalence of injury for this cohort was 36.6% and the injury incidence rate was 1.56 per 1000h of exposition. The most frequently injured body parts were the shoulder (23.5%), back (20.7%) and knee (7.8%). Estimated total indirect and direct costs per injury are CHF 3'414.45 (€ 3'281.29) or CHF 406'319.55 (€ 390'473.09) for all 119 reported injuries.

Discussion: The present data shows, that injury prevalence and injury incidence rate are comparable to prior research (Klimek et al., 2018; Mehrab et al., 2017; Sprey et al., 2016). The presented costs were lower than costs of injuries obtained from amateur soccer in Switzerland (Gebert et al., 2020).

Conclusion: Future research should aim to gain more insights into injury mechanisms and causes as well as set stronger focus on the costs of injury.

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Performance Diagnostics in Lead Climbing – Development of a Test Battery for Finger-Hand Strength

36

Abstract

Purpose: This study aimed to develop and evaluate a standardized economical test-battery with highest possible coefficient of determination of finger-hand strength and International Rock Climbing Research Association red point (RP) climbing level in lead climbing.

Methods: In a first phase an expert meeting was held to determine the test battery, based on a video analysis of the world championship 2019 in Hachioji and literature research. In the second phase 41 male climbers completed two maximal voluntary contraction (MVC) exercises in open grip (OG) and half crimp (HC) and two intermittent isometric contraction (IIC) exercises at 60% and 80% MVC per hand.

Results: The Model with the two factors MVC and IIC explained 70% (MVC: 46%, IIC: 24%) of the RP level. The highest variance resolution for the MVC explained the OG with the dominant hand ($R^2 = 0.50$, p-value <0.001), whereas in IIC the highest resolution is explained by the IIC 60% MVC non-dominant hand ($R^2 = 0.35$, p-value <0.001). The economical test battery which consists of these two tests has a variance resolution on the RP level of 60% (p-value <0.001).

Conclusion: Since this is an exploratory factor analysis, the results must be confirmed by a confirmatory factor analysis with more participants. Despite the small sample, the factor model is coherent and makes sense. This study confirms the importance of MVC in lead climbing, which should be taken especially as a training component for beginners. For the IIC-tests, additional tests should be analysed to explain a higher variance resolution of the model.

Keywords: Isometric exercise, Maximal strength, Exercise testing, Endurance, Forearm

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Impairment-Based Assessments for Patients With Lateral Ankle Sprain: A Systematic Review of Measurement Properties

Abstract

Purpose: The International Ankle Consortium developed the ROAST guideline for the assessment of impairments in patients with acute lateral ankle sprain (LAS) without consideration of measurement properties. Therefore, the aim of this study is to investigate measurement properties of clinical tests and patient-reported outcome measurements (PROM) for the assessment of individuals who sustained a lateral ankle sprain.

Methods: Following PRISMA and COSMIN guidelines, six electronic databases were searched until February 2021. Studies on measurement properties of specific tests and PROMs in patients with acute LAS and chronic condition following LAS including recurrent LAS and chronic ankle instability (CAI) were deemed eligible. Measurement properties were rated according to the COSMIN criteria.

Results: Forty-one studies totaling 2235 participants met the inclusion criteria. Eight studies investigated acute LAS, 33 recurrent LAS and CAI patients. Anterior Drawer Test in supine position five days post injury and Reverse Anterolateral Drawer Test are recommended in an acute setting in single studies. In the population of more than four weeks since injury, no studies investigated pain, physical activity level and gait. Only single studies reported on swelling, range of motion, strength, arthrokinematics and static postural balance. Cumberland Ankle Instability Tool (CAIT) (4 studies) as PROM, Multiple Hop (3 studies) and Star Excursion Balance Tests (SEBT) (3 studies) for dynamic postural balance testing showed good measurement properties.

Conclusion: There was good evidence to support the use of CAIT as PROM and Multiple Hop as well as SEBT for dynamic postural balance testing. There is insufficient evidence especially in the acute setting and on responsiveness of tests. Future research should assess measurement properties of clinical tests and PROMS of other impairments associated with LAS.

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38 Evaluation of Video-Based Education on Pelvic Floor Function and Dysfunction in Lay Women, Health Professionals and Sports Coaches

Abstract

Introduction: There are knowledge gaps in pelvic floor anatomy, function and dysfunction in women. Sports coaches and health professionals are working with customers and patients who are partly affected by pelvic floor dysfunction themselves. As understanding anatomy and function is part of health literacy and a basis for communication in health and sports settings, this study examined the knowledge of pelvic floor function and dysfunction in lay women, health professionals and sports coaches and tried to record whether an objective or perceived learning effect is present immediately and 4 weeks after an education video.

Methods: In a pre-post design with follow-up after 4 weeks an online questionnaire, with a pelvic floor education video embedded in the first one, was filled out. The content- and face-validated questionnaire contained socio-demographics, knowledge about the pelvic floor, prior knowledge, perceived knowledge and learning effect and attitude towards the video. Means and standard deviations from the knowledge score at three measurement points over all groups and per group and a linear mixed effects model was calculated.

Results: 117 participants completed all three questionnaires. After the intervention all groups showed a statistically significant difference in mean knowledge scores (p <.0001 for lay women, p <.0001 for health professionals, p = .0005 for sports coaches) before and after the video education. At follow-up all groups showed a loss of knowledge. Over 2/3 of group participants wished more information of the topic after the follow-up questionnaire.

Conclusion: An online education video increases the knowledge of anatomy, function and dysfunction of the pelvic floor directly after the video in lay women, health professionals and sports coaches. This is a feasible method who can reach a big group of interested and/or affected people in all groups and can lead to clear communication in and between groups. Studies with larger sample size for more evidence and with focus on improving long-term learning effect are recommended.

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Temporal Parameters in the Analysis of the Side Hop Test in Patients After Anterior Cruciate Ligament Reconstruction: A Cross-Sectional Study

Abstract

Background: The side hop test (SHT) evaluates the number of hops performed. It neglects important temporal parameters such as ground contact time related to the strategy of execution. The purpose of this study was to assess intra-rater reliability and construct validity of contact time parameters using its discriminant (side-to-side) and convergent (strength and psychological readiness) validity during the SHT with anterior cruciate ligament reconstructed (ACLR) patients.

Method: In this retrospective cross-sectional study, contact time was recorded by a video-analysis system. We examined the intra-tester reliability, discriminant validity (operated (OP) versus non-operated (NOP) side) and convergent validity (relation with strength and psychological readiness) of SHT contact time parameters, number of valid hops and corresponding's limb symmetry index (LSI) differences in 38 ACLR patients. Contact time parameters are presented as mean, standard deviation (SD) and coefficient of variation (CV) of contact time.

Results: Intra-tester reliability was considered as good to excellent for contact time parameters (ICC: 0.87 - 0.99). For discriminant validity, the mean and SD contact time of the OP leg was significantly longer than in the NOP leg (642ms vs 548ms and 251ms vs 200ms respectively, $p < 0.05$), although number of valid hops and CV contact time parameters were not significantly different. The LSI differences of the mean and SD contact time were significantly lower compared to the LSI differences of number of valid hops (-15% and -27% vs -3%, $p < 0.05$). Quadriceps was strongly correlated with mean contact time ($r = 0.60 – 0.73$; $p < 0.001$) for both legs. However, psychological readiness was not correlated with any contact time parameter.

Conclusion: Contact time parameters are reliable. In terms of discriminant validity, mean and SD contact time were valid parameter. These parameters can give useful information in clinical settings for the evaluation of strategy execution of patients during the SHT. However, CV contact time parameter was not valid in this study. Further studies are needed with better accuracy measurement instrument to measure its validity. In terms of convergent validity, low quadriceps strength resulted in longer mean contact time and higher variability, while contact time parameters were not influenced by psychological readiness.

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40 Effectiveness of Active Physiotherapy on Gait and Balance in Persons With Multiple Sclerosis: Systematic Review and Meta-Analysis

Abstract

Background: Multiple sclerosis (MS) is a progressive autoimmune inflammatory demyelinating disease of the central nervous system. A total of 2.8 million people are estimated to live with MS worldwide, when around 15,000 persons with MS (pwMS) are living in Switzerland. Physiotherapy is a key supportive treatment for pwMS and different modalities have been proposed to tackle different symptoms of MS. The aim of this systematic review and meta-analysis was (i) to summarise and (ii) to evaluate the most recently published articles regarding the effectiveness of active physiotherapy interventions on gait function and balance in pwMS (iii) and to highlight the influence of frequency and intensity of specific interventions and (iv) to propose clinical recommendations for balance and gait training in pwMS.
Methods: Studies published in the last five years (up to June 2021) were identified through the six electronic databases: Pubmed/MEDLINE, Web of science, Embase, CINAHL, Cochrane databases and Physiotherapy Evidence Database (PEDro). Study selection, data extraction and methodological quality assessment assessed with Cochrane Risk of Bias tool and PEDro were assessed independently through two authors.
Results: Sixty-four randomised control trials (RCTs) with 2931 subjects were included in this systematic review, twenty-five RCTs were included in the meta-analysis. About 66% of the included studies showed high risk of bias while mean total PEDro score of included studies was 6.03. The meta-analyses confirmed that active physiotherapy compared with no therapy can significantly improve balance on Berg Balance Scale (BBS) and gait function on 6-Minute Walk Test (6MWT), but not gait function on 2-Minute Walk Test (2MWT), Timed 25 Foot Walk Test (T25FW), 10 Meter Walk Test (10MWT) or Timed Up and Go (TUG).
Conclusion: The evidence presented in this systematic review with meta-analysis support the various active physiotherapy approaches and suggests that active physiotherapy compared with no therapy can significantly improve balance (measured by BBS) and gait function (measured by 6MWT) in pwMS.

Keywords: Multiple sclerosis, Postural control, Balance, Physical therapy, Gait, Meta-analysis

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Promotion of Physical Activity in Swiss Physiotherapy Practice: A Cross-Sectional Study

Abstract

Background: According to literature, physiotherapists potentially reduces inactivity as a factor for non-communicable diseases by promoting a physically active lifestyle. To explore gaps and opportunities in Switzerland, this study aimed (i) to examine to what extent physiotherapists in the German-speaking part of Switzerland promote physical activity (PA) in addition to therapeutic exercise and (ii) to evaluate barriers perceived by physiotherapists for the promotion of PA in their patients.

Methods: An existing English Questionnaire was translated to German and adapted to Swiss culture. Experts validated the questionnaire, and a pilot-test was performed before spreading the final anonymous web-based questionnaire. All physiotherapists in the German speaking part of Switzerland were eligible for participation. Explorative descriptive analysis was performed using polychoric correlations and chi-squared tests.

Results: Of 613 participating physiotherapists, 62% recorded to promote PA to ›50% of their patients per month. «Lack of time» and «feeling it would not change the patient's behaviour» were barriers reported by 23% and 37% of participants, significantly correlating to lower proportion of patients encouraged to be physically active. Content of the national recommendation of PA by the Federal Office of Public Health was heard of, but not known in detail by 56% of participating physiotherapists.

Discussion: Outcomes of this study in Switzerland were very similar to a previous study in Australia. Differences between studies were found in reported barrier «Lack of time» (23% in Switzerland vs. 13% in Australia). This difference can be explained by the more established use of group therapy in promoting physical therapy in Australia (96%) compared to their Swiss counterparts (18%).

Conclusion: Increasing specific counselling skills like motivational interviewing and knowledge about PA recommendations among physiotherapists might positively influence the number of patients being encouraged to lead a physically active lifestyle. This might directly influence the burden of non-communicable diseases in Switzerland.

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Implementation of an Inter-Professional, Multi-Component Assessment of Risk of Fall in a Specialized Geriatric Hospital: A Contextual Analysis

Abstract

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Purpose: For the identification of patients at risk of falling in hospital, the use of a fall risk assessment is inevitable. However, assessments are not always performed reliably and need to be adapted to the appropriate setting. The context analysis of the current study helps to identify existing barriers and facilitating factors and to define implementation strategies for a successful implementation.
Methods: This study applied a mixed-method, sequential, explanatory design and was conducted in a geriatric hospital. For the quantitative part of the study, a questionnaire was sent to the health personnel, and in the qualitative part the obtained results were deepened in focus groups.
Results: The health care professionals are dissatisfied with the communication among their colleagues and the content of the current fall risk assessment and express a desire for change. In the questionnaire as well as in the focus groups, the topics «Communication and Networking,» «Evidence/Strength and Quality,» and «Complexity» were identified as major barriers by health care professionals.
Conclusion: Based on the results, the length and content of the fall risk assessment will be adapted. Appropriate implementation strategies, developed using the ERIC-CIFR matching tool and discussed in an expert group, will be used to ensure successful implementation. A successful fall risk assessment needs an interprofessional approach, clarification of feasibility and evidence. Barriers can be highly individual, depend on the institution, and the context analysis of one hospital can only be transferred to other settings to a limited extent.

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Cost-Effectiveness of Optimized Non-surgical Care For Knee Osteoarthritis: A Model-Based Health Economic Evaluation

Abstract

Objective: To assess the incremental cost-effectiveness ratio (ICER) of optimized non-surgical care (ONC) versus usual non-surgical care (UNC) in adults with symptomatic, radiographically confirmed knee osteoarthritis (KOA) and to assess the effect of total knee replacement (TKR) delay on the amount of revision surgeries and the corresponding cost-effectiveness.

Methods: We conceptualized a Markov model from the Swiss healthcare perspective to compare ONC (exercise, education, insoles, weight management, painkillers) versus UNC (written advice, painkillers). Costs were derived from two Swiss health insurers, a national database, and a reimbursement catalogue. Utility values and transition probabilities were extracted from published clinical trials and national population data. The main outcome was the incremental cost per additional quality-adjusted-life-year (QALY) for three scenarios: UNC versus ONC with no delay of TKR (base case), two-year delay and five-year delay of TKR. Costs and utilities were discounted at 3% per year. Probabilistic sensitivity analyses were conducted.

Results: In the «base-case scenario», ONC versus UNC led to 0.155 additional QALYs per-person at an additional per-person cost of CHF 333 (ICER = CHF 2145 / QALY gained). The «two-year delay scenario» led to 0.140 additional QALYs and CHF -21 per-person cost. The «five-year delay scenario» led to 0.118 additional QALYs and CHF -508 per-person cost. Delay of TKR by two and five years led to a 17% and 37% reduction of revision surgeries.

Conclusion: ONC would likely be cost-effective in the Swiss healthcare system. The delay of TKR by ONC may reduce revision surgeries.

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44
Impact on Sensory and Nociceptive Thresholds and Pain Experience: A Case Series

Abstract

Introduction: Fibromyalgia (FM) is a multifactorial disease, often characterized by muscle pain all over the body, fatigue, sleep and psychological problems. Therapy recommendations include a multidisciplinary approach, including regular aerobic exercise. Participation in active therapies in patients with FM appears to be poor due to lower pain thresholds. This case series investigates whether sensory and nociceptive thresholds, as well as pain experience, are altered after passive whole body hyperthermia (GKHT).

Methods: Four female patients with FM were included in the Case Series. Quantitative sensory testing (QST) was used to measure sensory and nociceptive thresholds. Also, four questionnaires (pain severity score part 2a and part 2b, widespread pain index, pain severity according to von Korff, and pain description list) were used to elicit pain experience. Data were collected before and after the intervention with passive GKHT (raising core body temperature to 38ºC). All outcomes were analyzed and described descriptively for each patient case individually.

Results: The results show positive changes in pressure pain threshold in all four patients, and positive changes in heat pain threshold in three of four patients. Three of the four patients show different positive changes in sensory thresholds and one patient had no positive changes. Seven days after the intervention, three of the four patients show positive change in affective and sensory pain experience. The remaining questionnaires revealed little to no change in pain experience.

Conclusion: In summary, these results of passive GKHT indicate a majority positive change in nociceptive thresholds and a partial positive change in sensory thresholds. However, little to no change of GKHT on pain experience can be shown within the measured time. In the future, methodologically stronger studies, including follow-up, are needed to further validate these promising results and determine the generalizability of the effects of passive GKHT in FM.

Keywords: Quantitative sensory testing, QST, Therapeutic hyperthermia, Fibromyalgia, Pain threshold, Sensory threshold, Pain

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Audio-Biofeedback Versus the Scale Method for Partial Weight-Bearing Instruction in Persons Over 60: A Randomised Pilot Trial

Abstract

Background: Reduced weight-bearing is recommended following most fractures and orthopaedic surgeries of the lower limb. However, adherence to weight-bearing restrictions is challenging, particularly for older adults. This randomised pilot trial assesses the feasibility of a sensor insole system, including the effectiveness of its audio-biofeedback function compared to traditional methods, in the instruction and measurement of partial weight-bearing in seniors.

Methods: Included were persons over 60 years of age, without severe cognitive impairment, and able to walk unaided for 10 minutes. Demographic information, cognitive function and grip strength were assessed. Participants were randomised into two groups and walking with crutches was instructed. Partial weight-bearing of 20 kg was trained with audio-biofeedback in the intervention group and the scale method in the control group. The degree of weight-bearing (ground reaction force) was measured using sensor insoles (OpenGo, Moticon ReGo AG, Munich, Germany) during functional mobility activities. A mean load between 15-25 kg was arbitrarily defined as adherent. Linear regression analyses were performed to identify influencing factors. Users' experience of the OpenGo system was noted.

Results: Thirty volunteers participated in the trial (age: 71±6 years; weight 74±17 kg). For the sit-stand-sit activity, means of maximal weight-bearing for both groups (21.7±16.6 kg versus 22.6±13 kg) were within the target range. For standing, mean total load was below the 15 kg threshold for both groups (10±7 vs. 10±10 kg). Means of maximal weight-bearing were above the 25 kg threshold for both groups for: walking (26±11 vs. 34±16), walking with 4 kg backpack (27.3±12.2 vs. 34.3±16.9), step-up (29±18 vs. 34±20 kg) and step-down (28±15 vs. 35±19 kg). The difference in means did not reach statistical significance for any activities measured. Lower cognitive function, older age, and a higher body mass index were associated with poorer adherence. Participants found the insoles comfortable and useability of the OpenGo system was satisfactory.

Conclusion: The audio-biofeedback function delivered no statistically significant benefit over traditional methods. However, the results of the randomised pilot trial provide important information for future studies on partial weight-bearing training and associated feedback in seniors, potential influencing factors, and the OpenGo system as a measurement tool.

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Reliability of the «Quality First» Assessment: Evaluation of Hop Test Movement Quality to Enhance Return to Sport Testing – A Cross-sectional Study

Abstract

Background: A Return to Sport test with functional hop tests is used to decide when a person is ready to return to sport after an anterior cruciate ligament (ACL) injury. Poor movement quality is considered a risk factor for ACL injury. However, it is unclear whether existing tests adequately capture quality of movement. This study aims to examine the reliability of the newly developed «Quality First» assessment for evaluating movement quality in hop tests. The second aim is to investigate whether there is a relationship between the calculated limb symmetry index (LSI) of hop tests and the total score of the «Quality First» assessment.

Study Design: Cross-sectional study.

Methods: The study recruited 34 patients with an ACL reconstruction. The vertical hop, single-leg hop for distance, and side hop tests were performed and recorded from a frontal view. The video recordings were assessed using the «Quality First» assessment. The maximum total score for the single-leg hop for distance and vertical hop test is 24, and for the side hop, 18 points. The inter- and intrarater reliability were evaluated. Intraclass correlation coefficients (ICC) and standard error of measurements (SEM) were used to calculate reliability. The Spearman correlation coefficient was calculated using the LSI and the «Quality First» total score.

Results: The interrater reliability of the «Quality First» assessment showed fair to good reliability (ICC2: 0.45–0.60), with SEM ranging from 1.46 to 1.73. Intrarater reliability was good to excellent (ICC3: 0.73–0.85), with SEM values ranging from 0.89 to 1.09. The correlation between the LSI and the «Quality First» total score showed no correlation for all three jumps ($r = -0.1$-0.02 / p-value = 0.65 - 0.93).

Conclusion: The «Quality First» assessment shows fair to good reliability when used by different raters. When used multiple times by the same rater, the assessment has good to excellent reliability. However, the quality of movement, measured with the «Quality First» assessment indicated no correlation with the LSI. This should therefore also be examined in Return to Sport tests.

Keywords: Reliability, Movement Quality, Hop Test, Anterior Cruciate Ligament, Return to sport

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Interrater Reliability of the Fugl-Meyer Motor Assessment – German Version: A Quality Management Project Within the ESTREL Study

Abstract

Question: What is the interrater reliability of the German version of the Fugl-Meyer Motor Assessment (FMMA) on an overall score level and on item level videotaped at the three-month visit of stroke patients with a clinically important motor deficit at onset – performed by two trained, independent assessors in the remote evaluation of 50 video recordings?
Methods: FMMA videos of 50 individuals three months post stroke – primary outcome in the ESTREL study (Enhancement of Stroke Rehabilitation with Levodopa: a randomized placebo-controlled trial) – were independently scored by two trained, experienced assessors. The interrater reliability of the German FMMA was investigated for the overall score and item levels using intra-class correlation coefficients (ICC) for the total scores of the FMMA (primary endpoint) and Spearman's rank-order correlation coefficients (Spearman's rho), percentage agreement, weighted Cohen's kappa coefficients, and Gwet's AC1/AC2 coefficients (secondary endpoints). Results were compared with values from corresponding published studies on English and other language versions and interpreted based on appropriate benchmarking. Possible interventions were recommended to improve the application of the German FMMA and its implementation in clinical studies as well as in daily physiotherapeutic practice.
Results: ICCs were classified as excellent for the total scores of the entire German FMMA and the total scores of the FMMA for the upper extremity (FMMA-UE) with a value of 0.98 (95% confidence intervals (CI) 0.96-0.99) and as moderate for the total scores of the FMMA for the lower extremity (FMMA-LE) with a value of 0.85 (95% CI 0.70-0.92). Spearman's rho ranged from 0.61 to 0.94 for total and subscale scores. Item-based interrater reliability parameters consisted of per-centage agreement (median 77%, range 44-100%), weighted Cohen's kappa coefficients (median 0.69, range 0.00-0.98) and Gwet's AC1/AC2 coefficients (median 0.84, range 0.42-0.98).
Conclusion: The German FMMA is a highly reliable measuring instrument regarding the overall score level – similar to the English version. Total scores are suitable for clinical practice and research, while there is still potential for improvement at the item level. Specific training is an important starting point here.

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48 Balance Reaction and Motor Control During Simulated Fear of Heights in Children With Cerebral Palsy – A Case-Control Pilot Study

Abstract

Purpose: Cerebral palsy (CP) is associated with postural instability and a high propensity for falling, leading to physical and psychological impairments, such as increased fear of falling (FoF). Fear-related changes in postural stability can elicit adaptations in spinal reflex activity in healthy adults. This study aimed to establish whether virtual reality (VR) protocols can elicit FoF, and hence recreate fear-related changes in postural stability and spinal reflex activity in controlled laboratory environments in children with CP and their typically developed (TD) peers.

Methods: Ten participants (5 CP, 5 TD; age 11y, range 8-13y) were included in this case-control pilot study. Participants were instructed to stand still (2x40s per condition) on a plank at two different virtual heights (0m, 10m) in a randomized order. Self-perceived unsafety and FOF levels were recorded using a numeric rating scale (NRS, 0-10). Spinal reflex activity was quantified by the tibial H-reflex through surface EMG of the M. soleus in the dominant or non-dominant leg. Standing balance was assessed on dual force plates measuring overall pathlength, ellipse area, mean power frequency (MPF) and displacement of the centre of pressure (COP) in all directions.

Results: All children experienced increased unsafety (p=0.01) and FoF (p=0.06) while exposed to the 10m virtual height compared to 0m height, with a greater change in CP compared to TD (p=0.02). H/Mmax ratio adaptations were highly individual under postural threat with a tendency to decrease in TD (-2.0, p=0.6) and no modulation in CP (-0.1, p=1). Greater virtual height increased the COP displacement and ellipse area in the dominant leg in both groups. In addition, participants with CP exhibited a decreased displacement and increased MPF in the impaired leg. These leads to an asymmetric balance reaction in CP.

Conclusion: Our findings suggest VR as a valuable tool for assessing the effect of unsafety and FoF on both postural stability and spinal reflex activity in children with and without cerebral palsy. These results indicated that in CP, cortical influence on balance and reflex inhibition decreases especially on the impaired side while peripheral motor control increases under elevated virtual height conditions.

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Changes of Spinal Cord Injury Related Neuropathic Pain and Brain Activity After Virtual Walking – A Single Case Study

Abstract

Background and aims: Chronic neuropathic pain (NeP) is highly prevalent among individuals with spinal cord injury (SCI). However, current best practice treatment shows unsatisfactory results. This might be due to poor understanding of the underlying mechanisms. Literature suggests that chronification of pain might be linked to functional and structural changes in the brain. A treatment that is discussed to target those changes in SCI is a virtual walking (VW) training program. The aim of this study was to enhance the knowledge of the underlying mechanisms of chronic NeP in SCI by exploring the association of changes in pain perception and changes in brain activity after a VW training program.

Methods: One individual with SCI and chronic neuropathic bellow-level pain was included in this study and performed a VW training program of six weeks duration. Pain intensity, pain quality, pain distribution and psycho-social aspects of pain as well as brain activity patterns and brain metabolite levels were assessed at baseline (T1), directly after the VW training program (T2) and at a four-week follow-up (T3). Results: A trend of pain intensity reduction and a reduction of maximum pain intensity by 33% as well as increased functional connectivity in the primary visual cortex, and in the cerebellum were observed directly post intervention. Furthermore, magnet resonance spectroscopy showed a notable increase in total N-Acetyl-Aspartate (tNAA) (+37%), and total Creatine (tCr) (+23%) and a notable decrease in myo-inositol (mI) (-55%) in the anterior cingulate cortex (ACC), as well as an increase of tNAA (+3%), tCr (+18%) and mI (+36 %) in the thalamus comparing T2 to T1. However, no notable long-term effects could be observed at the four-week follow-up.

Conclusion: Due to multiple limitations no firm conclusion could be drawn. However, the results suggest that a VW training program might be an effective tool to address SCI related NeP by targeting SCI related motor-sensory incongruency and maladaptive cortical processes. Therefore, VW should be considered as a supplementary non-pharmacological treatment option in SCI related NeP.

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