

Abstracts 2017

**Masterarbeiten Master of Science  
in Physiotherapie (MScPT)  
Studiengang 2014**



# Editorial

Sehr geehrte Leserin, sehr geehrter Leser

Wir freuen uns, Ihnen hiermit die Sammlung der Abstracts der Masterarbeiten des bereits fünften Studiengangs MSc in Physiotherapie MScPT zu überreichen.

Die Studierenden des MScPT beschäftigen sich in ihren Masterarbeiten nebst dem Fachthema intensiv mit qualitativen und quantitativen Forschungsmethoden. Einige Abstracts zeigen Studien und Reviews deren Ergebnisse sich in die klinische Praxis transferieren lassen. Andere Abstracts zeigen Studien, die Grundlagen für weitere grosse Studien gelegt haben. Die meisten Arbeiten werden schliesslich in peer-reviewed Journals publiziert und/oder an nationalen und internationalen Kongressen präsentiert.

Unser Dank geht wieder an alle Dozierenden sowie Betreuerinnen und Betreuer der Masterarbeiten für ihre kompetente und professionelle Unterstützung der Studierenden.

Wir freuen uns über Ihr Interesse an diesen Arbeiten und wünschen Ihnen eine anregende Lektüre.



A handwritten signature in black ink, appearing to read 'K. Niedermann'.

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## Direct Access to Physiotherapy in Switzerland: A Qualitative Study of Key Stakeholders' Opinions, Barriers to and Facilitators of the Establishment of Direct Access

**Background:** Several European countries established direct access to physiotherapy as a way of benefitting from physiotherapists' capabilities in treating patient complaints conservatively. Improved treatment outcomes, decreased treatment costs as well as an increase in patient satisfaction and physiotherapists' autonomy provided evidence for the positive effects of establishing direct access. In Switzerland, patients still need referrals from physicians to gain access to physiotherapy treatments, whereas rising healthcare costs and staff shortages put the healthcare system in jeopardy. Current political developments suggest that key stakeholders continue to reject direct access. The objective of this study was to investigate key stakeholders' opinions, barriers to and facilitators of the establishment of direct access to physiotherapy in Switzerland.

**Methods:** Semi-structured interviews with Swiss health policy makers, health insurance agents, physicians and physiotherapy educators were conducted. An interview guide was elaborated. Data were transcribed and analysed using thematic analysis.

**Results:** Twelve interviews were conducted and four overall themes were defined that reflect the levels of barriers to and facilitators of the establishment of direct access: Significance of physiotherapy in Swiss healthcare, the demand for a new healthcare system, possible consequences and potential benefits of direct access and prerequisites for the establishment of direct access. Ambivalent views on physiotherapy were identified as the key stakeholders regarded the importance of physiotherapy as evident but at the same time questioned its benefits. Three politically influential key stakeholders disapproved the establishment of direct access, whereas the majority of the key stakeholders supported this idea. Mentioned barriers were the concerns of potential loss of importance for general practitioners, less treatment coordination and rising healthcare costs. The physiotherapists' contribution to the debate on interprofessional collaboration and more research concerning the effectiveness of physiotherapy and direct access were mentioned as facilitators.

**Conclusions:** The results of this study showed that a general demand for change in the Swiss healthcare system seems to be ubiquitous. Physiotherapists need to ensure a number of prerequisites for deriving benefit from this demand to strengthen the physiotherapy profession, and to consider further endeavours for the establishment of direct access to physiotherapy.

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# Best practice: Wie ein multifaktorielles Sturzpräventionskonzept in einem Alterszentrum der Stadt Zürich umgesetzt wird – eine Querschnittstudie

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**Hintergrund:** Seit 2009 besteht in einem Alterszentrum der Stadt Zürich trotz Anwendung eines multifaktoriellen Sturzpräventionskonzepts (mSP-Konzept) eine gleichbleibende jährliche Sturzrate von 52 Prozent der Bewohnerschaft.

**Ziel:** Erhebung, wie beim Personal (Leitung, Pflege und Betreuung) und der Bewohnerschaft das seit 2009 eingeführte mSP-Konzept gelebt wird. Aus diesen Erkenntnissen werden Faktoren abgeleitet, welche die Umsetzung des Konzepts fördern bzw. hemmen sowie werden Ansatzpunkte zur Optimierung der Umsetzung herausgearbeitet.

**Methode:** Die Querschnittstudie wurde mit quantitativer Datenerhebung, mittels schriftlicher Befragung beim Personal Pflege- und Betreuung (Personal Pfl + Be) (n=18) zu Kenntnisstand und Einstellungen zum mSP-Konzept und qualitativer Datenerhebung mit semistrukturierte Interviews und Fokusgruppendifkussionen beim „Personal Pfl + Be“ (n=11) „Leitung“ (n=2) und „Bewohner“ (n=7) durchgeführt, um eine vertiefte Sicht derer Wahrnehmung und Einschätzung zu gewinnen, welche mit zusammenfassender Inhaltanalyse ausgewertet wurde (Mayring, 2010).

**Resultate:** Die Ergebnisse der schriftlichen Befragung (Rücklaufquote 60%) und der qualitativen Befragungen ergaben, dass das Personal Pfl + Be im Alltag insgesamt über einen gut verankerten Kenntnisstand zum mSP-Konzept von über 80 Prozent verfügt und sich an das Konzept (Adhärenz) (100%) hält, sowie betrachten 50 Prozent das Konzept als Instrument zur Qualitätsverbesserung. Die Leitung stellt genügend personelle und materielle Ressourcen (Rollstühle) zur Verfügung. Rapporte finden im interdisziplinären Austausch und mit der Leitung regelmässig statt. Die Bewohner erleben die Sturzprävention v.a. bei Eintritt und Zimmerabklärung durch das Personal Pfl + Be, sowie durch den Austausch untereinander.

**Schlussfolgerung:** Die Umsetzung des mSP-Konzepts im Alterszentrum zeigt auf, wie auf allen Ebenen ein Konzept im Sinne von ‚best practice‘ gelebt und umgesetzt werden kann. Es konnten keine eindeutigen Faktoren abgeleitet werden, welche die Umsetzung des Konzepts behindern. Umsetzung und Kenntnisstand der Pflege und Betreuung zum mSP-Konzept scheinen keinen Einfluss auf die Sturzrate zu haben, geringfügige Unterschiede in Umsetzung wurden aber vielleicht mit den gewählten Untersuchungsmethoden nicht erfasst. Für die Sturzrate müssen andere Faktoren in Betracht gezogen werden, welche z.B. im Zusammenhang mit Gewichtung der Erhaltung und Ermöglichung von Autonomie der Bewohner stehen.

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# Analysing Muscle Activity during different Shoulder Joint Angles in Shoulder Patients

**Background:** Shoulder problems are the second common dysfunctions of the musculoskeletal system. A dynamic orthosis controlled by EMG signal of the deltoid was developed to assist patients with shoulder dysfunctions during flexion and abduction.

**Methods:** The trapezius descendens and the deltoid on both sides of 20 participants with different shoulder dysfunctions were measured with EMG. Two active and two passive tasks of flexion and abduction were performed and the corresponding muscle activity was measured. Data was evaluated for 30°, 60° and 90° active flexion and abduction and once for passive flexion and abduction with a maximum of 120°. Wilcoxon test was calculated to determine differences in the muscle activity between the non-affected and affected side during the active tasks. The mean muscle activity during 10 seconds passive flexion and abduction of the affected shoulder was estimated to identify the activity of the deltoid and trapezius.

**Results:** In active tasks significant differences in muscle activity were found for 60° of flexion for deltoid posterior ( $p = 0.027$ ) and for 90° of flexion for deltoid medius ( $p = 0.02$ ). In passive tasks most participants had a high activity for trapezius over 10% of the MVC. The deltoid demonstrated a low muscle activity. Five subjects showed in average a deltoid muscle activity over 10% of the MVC.

**Conclusion:** It seems to be difficult for shoulder patients to contract the deltoid muscle isolated. To control the orthosis possibly a different muscle should be selected.

Betreuungsperson

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# Outdoor walking training versus cycle ergometer training during inpatient rehabilitation in patients with COPD GOLD stages III to IV: a feasibility randomized controlled trial

Walking is one of the most important activities of daily living in patients with Chronic Obstructive Pulmonary Disease (COPD). Walking requires endurance. However, most endurance training programs use cycle ergometer. Objectives of this study were to 1) evaluate the feasibility of a randomized controlled trial comparing outdoor walking training (WT) and cycle ergometer training (CT) in patients with COPD GOLD stages III-IV in an inpatient rehabilitation setting and 2) estimate the effect on health-related quality of life, physical capacity and physical activity after three weeks treatment and three months follow-up.

A single blind randomized controlled feasibility trial with three months follow-up in the rehabilitation center Walenstadtberg, Switzerland was conducted.

Sixteen patients were included, recruitment rate was 33% (16/48).

Participant's completed 75% of scheduled trainings. The follow-up rate was 100%. All participants were satisfied with the WT. The WT had better health-related quality of life after three weeks training compared with the CT ( $p=0.042$ , 95%CI 1.06-49.94, effect size ( $d$ )=1.19). There were no exacerbations in the WT and three in the CT after three months follow-up. There was no significant difference for the other outcomes.

In conclusion, the study design and the WT were feasible. Health-related quality of life improved in the WT compared to CT after three weeks inpatient rehabilitation in the WT. A minimum of 46 participants is needed for a randomized controlled trial.

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## A cross-sectional study in healthy individuals on EMG muscle activation pattern of four lower extremity muscles during stair climbing, motor imagery and robot-assisted stepping

**Background:** Stair climbing seems to be a challenging part in the daily life of stroke survivors and often turns out to be a limiting factor for participating. Motor imagery (MI) and robot-assisted therapy are common and effective approaches focusing on the relearning of selected movements. The aim of this study was to understand the muscle activity patterns during stepping task on robot-assisted tilt table (RATT) and MI of stair climbing and compare them to real stair climbing.

**Methods:** EMG data of four muscles of the dominant leg from twelve healthy participants (8 female, 4 males; mean age  $50.3 \pm 14.6$  years) were analysed: M. rectus femoris (RF), M. biceps femoris (BF), M. tibialis anterior (TA) and M. gastrocnemius medialis (GM). Participants performed alternating stair climbing (SC), stepping task on RATT and MI of stair climbing. MI ability was assessed using mental rotation (MR), mental chronometry (MC) and the short form of kinaesthetic and visual imagery questionnaire (KVIQ-10). Spearman correlation of the EMG activation modulation of all conditions (1), differences in timing aspects (2), intensity of activation (3) and MI EMG activity with rest and preparation phase (4) were conducted using Friedman analysis of variance and Wilcoxon test. Differences in MI abilities of complex and simple task (5) were analysed with t-test.

**Results:** (1) The EMG activation modulation was found to correlate between SC and RATT in RF ( $r=0.491$ ), BF ( $r=0.750$ ) and TA ( $r=0.699$ ) over one step. (2) EMG activity intensity was found to be the highest in SC and the lowest in MI. No significant difference of the time point of maximum activation could be shown between SC and RATT. (4) No significant increase of EMG activity could be found in any of the muscles ( $p>0.017$ ) during MI. (5) MI ability did not differ in visual ( $p=0.719$ ) or kinaesthetic ( $p=0.846$ ) dimension.

**Conclusions:** Stepping task on RATT was found to produce similar activation patterns compared to SC in healthy adults. The positive impact of MI abilities on complex tasks could underline relearning of SC. Further investigations are needed to apply these findings on stroke survivors.

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# Reflection in clinical education of undergraduate physiotherapy students in Switzerland: an ethnographic approach

**Introduction:** Reflective capacity is an important characteristic for professional competence in physiotherapy for a continuous professional development. Clinical education is essential for physiotherapy students to learn reflection and, therefore, clinical educators play a vital role to foster reflection by creating a supportive environment and applying various strategies. The evidence to support the implementation of reflection is mostly theoretical and there is little to guide clinical educators on how to implement and foster reflection. Therefore, the aim of this study was to investigate how Swiss clinical educators foster reflection in undergraduate physiotherapy students.

**Methods:** This study adopted an ethnographic approach. Observations of formal educational situations (n=34) and contemporary semi-structured interviews (n=6) with each clinical educator after observations were conducted. Fieldnotes were collected and complemented with audio-recordings of observations. The interviews were audio-recorded and transcribed. The inductive data analysis followed a systematic thematic analysis guided by questions.

**Findings:** Different types of educational situations could be observed. Three main themes were identified: management learning process, self-assessment and deliberate actions. Several subthemes described tools of clinical educator to foster students' reflection. Based on these findings a model of how reflection is fostered in the observed context has been outlined.

**Discussion and Conclusion:** The study provided support for the conclusion that reflection is implemented in a well-structured procedure with a self-determined learning approach of students and clinical educators acting as coaches. Different educational situations provided a framework for students' reflection, whereas, tools to foster were mainly implemented during debriefings after supervisions. The findings, furthermore, revealed that clinical educators implement reflection strongly related to students' self-assessment and deliberate actions. It is proposed that clinical educator should choose their strategies to foster reflection in an individual learning process of students deliberately and be cautious of a too routine implementation without awareness of the students and themselves.

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## Ethische Herausforderungen in der Physiotherapieforschung: Eine qualitative Studie zur Wahrnehmung von ethischen Herausforderungen in der Physiotherapieforschung in der Schweiz

**Hintergrund:** Nicht erst die jüngere Geschichte zeigt, dass es bei der Forschung am Menschen ein Spannungsfeld zwischen dem Forschungsinteresse und allgemeingültigen Werten und Normen gibt.

Mit der Erstellung von Ethikanträgen und der Kontrolle von medizinischen Studien durch neutrale Instanzen sollen die Rechte der Probanden geschützt werden. Auch in der Physiotherapieforschung sind Forscherinnen und Forscher mit ethischen Problemen konfrontiert, jedoch gibt es momentan noch keine einheitlichen Richtlinien.

Im Zuge der Professionalisierung der Physiotherapie ist daher eine grundlegende Begutachtung ethischer Probleme in der Forschung notwendig.

**Zielsetzung:** Ethische Herausforderungen in der Physiotherapieforschung aufzudecken, zu illustrieren und in geeigneter Form zu analysieren.

**Methode:** Zur Beantwortung der Forschungsfrage wurde der Qualitative Forschungszugang gewählt und semi-strukturieren Experteninterviews mit Forschenden aus dem Bereich der Physiotherapie und Personen, die im Bereich der Ethik arbeiten, durchgeführt.

**Ergebnisse:** Ethische Herausforderungen, welche Inhalt der Interviews sowohl von Forschenden aus dem Bereich der Ethik als auch der Physiotherapie waren, sind: gesellschaftlicher Nutzen, gutes wissenschaftliches Arbeiten, Auswahl der Probandinnen und Probanden, günstiges Risiko-Nutzen-Verhältnis, Informierte Einwilligung, Wahrung der Rechte der Teilnehmenden, Physiotherapie als körperliche Praxis, therapeutisches Missverständnis und Einsatz von Placebos und Kontrollgruppen.

Darüber hinaus wurden die folgenden Punkte nur von Forschenden aus dem Bereich der Ethik (E) oder aus dem Bereich der Physiotherapie (P) genannt: externe Überprüfung der Forschung (E), Rekrutierung innerhalb der Berufsgruppe (E), Behandlung von Drop-Outs (E), Fehlende wissenschaftliche Grundlage (P), qualitätsmindernder Einfluss der Ressourcen auf die Studie (P), Bewusstsein über eigenen Einfluss auf die Studie (P), Aufklärung der Probandinnen (P) und Probanden nach Abschluss der Studie über Ergebnisse (P).

**Diskussion:** Die Wahl des Qualitativen Forschungsansatzes erwies sich bei der vorliegenden Arbeit als sinnvoll, da die ganzheitliche Betrachtung einer Begebenheit im Vordergrund stand und noch wenig Literatur in diesem Gebiet vorhanden ist. Die Arbeit kann als erste Grundlage für weitere Arbeiten in diesem Bereich dienen.

Aus den Interviews und im Vergleich mit bestehender Literatur wird deutlich, dass es ethische Herausforderungen in der Physiotherapieforschung geben könnte, welche sie von anderen Forschungsdisziplinen unterscheidet. Mögliche Unterscheidungspunkte liegen im Bereich der körperlichen Nähe, welche mit einer physiotherapeutischen Behandlung einhergeht, fehlende wissenschaftliche Grundlagen der jungen Forschungsdisziplin und dem qualitätsmindernden Einfluss der geringen Ressourcen in diesem Forschungsbereich.

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# Do patients with non-specific low back pain with movement control impairments also have altered lumbar spine to hip ratios? A cross-sectional study

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**Study design:** Retrospective cross-sectional trial.

**Objectives:** To compare lumbopelvic flexion and extension ratios for non-specific low back pain (NSLBP) patients with and without a movement control impairment (MCI) and to assess if alterations in lumbopelvic ratios can be observed during spontaneous trunk movements.

**Background:** MCI is a relevant subgroup of NSLBP. Identification of MCI is based on isolated lumbopelvic movements and physiotherapists are considered experts in examining aberrant movement patterns. However, alterations in lumbar spine to hip ratios in the NSLBP subgroup of MCIs has yet to be determined.

**Methods:** Sixty-four participants with NSLBP performed a set of MC tests and spontaneous trunk flexion and extension movements for ROM measurements. Differences in lumbar spine to hip ratios at early and late ranges were compared via Mann-Whitney U tests and association between MCI tests and lumbopelvic ratio observation was analyzed using chi-square statistics.

**Results:** A greater proportion of women than men displayed MCI and lumbopelvic flexion ratios showed to be related to pain intensity. Lumbar spine to hip ratios did not differ between NSLBP patients with and without MCI at early and late flexion and extension ranges. A chi-square test revealed no relationship between MC test result and lumbopelvic observation rating. Patients with aberrant lumbopelvic extension pattern showed significantly higher ratios than the aberrant flexion pattern subgroup.

**Conclusion:** Gender-specific differences, as well as direction- and pain-related influences on lumbar spine-to-hip ratios, but no ratio differences between MCI and no MCI were found. Further research on NSLBP subgroup-specific movement kinematics are needed for clinical purposes.

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# Biomechanical Effect of Different Shoe Conditions on Lower Extremity and Trunk of Healthy Adults – a Mono-centric Observational Cross-Sectional Study

**Background:** Unstable shoes (US) use instability as a strategy to strengthen muscles. The kyBoot is a US characterised by its special soft-elastic sole. Although worn by patients with foot, leg, or back problems and healthy people, its biomechanical effect has so far remained unknown. Therefore, the aim of the study is a biomechanical comparison between the kyBoot and a control shoe (CS).

**Method:** Fifteen healthy subjects (8 females, 7 males) underwent a gait analysis, measuring vertical loading rates and electromyography of lower limb and trunk muscles during standing, walking, and walking while carrying a crate (walk5). 30" of standing and a mean of seven separate gait cycles were analyzed. Differences between footwear conditions were tested with the Wilcoxon-test ( $P < 0.05$ ).

**Findings:** Increased intensity was found in the gastrocnemius medialis (GaM) ( $P = 0.041$ ) and peroneus longus (PL) ( $P = 0.016$ ) activity during standing in the kyBoot. During walking, the lumbar multifidus (ML) ( $P = 0.019$ ), biceps femoris (BiF) ( $P = 0.039$ ) and tibialis anterior (TA) ( $P = 0.008$ ) were longer active in the kyBoot. During walk5, the ML ( $P = 0.041$ ) and BiF ( $P = 0.041$ ) intensity in swing phase, TA duration ( $P = 0.041$ ) and walking speed ( $P = 0.036$ ) were increased in the kyBoot. Furthermore, the vertical instantaneous loading rate (VILR) was reduced in the kyBoot ( $P < 0.01$ ).

**Interpretation:** Biomechanical effects wearing a kyBoot differ from those wearing a CS. These effects could be beneficial for the human locomotor system. As reduced VILR is a sign of shock absorption and due to increased muscle activity, there are clinical implications for therapeutic use.

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# Assessment of center of pressure excursion while sitting after stroke

Regarding early sitting balances after stroke is one of the highest predictors of functional ability at discharge from rehabilitation. It requires an appropriate measurement tool. The aim of this study is to investigate the validity of center of pressure (CoP) excursion of certain tasks while sitting on a force platform and to examine the daily variability of trunk control after stroke. Therefore, 20 post-stroke patients at their inpatient rehabilitation underwent two assessment sessions on average 8.2 hours apart. Each session consisted of two trials: quiet sitting for 30 seconds, reaching as far as possible forward and backward as well as to the left and right. Additionally, at the first session, the Trunk Impairment Scale (TIS) was also scored. CoP displacement was measured to determine the sway area and velocity during stable sitting and the maximal excursion in frontal and sagittal plane during reaching tasks. High Spearman correlations (0.72, 0.79) between the TIS and the frontal and sagittal excursion were determined. Only small correlations between the TIS and the sway area or sway velocity were seen. CoP outcomes showed high ICCs (0.73-1.00) within sessions and mostly high ICCs (0.86-0.93) between sessions. The sway velocity showed a poor between session ICC of 0.51. The only significant difference was measured between session one and two in the sway area. The frontal and sagittal excursion during reaching tasks seem to be valid parameters to evaluate trunk control in patients after a stroke and show only little variability with no significant differences between measurements.

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## Physiological parameters in rowing performance – a prospective pilot study on a Swiss sample

**Introduction:** Current literature shows unclear findings as regards to physiological parameters associated with rowing performance, especially where aerobic and anaerobic capacity is concerned. The aim of this study was to examine which physiological parameters are associated with rowing performance on-water and on-ergometer using field tests on a group of athletes who participate in Swiss national competitions.

**Methods:** For this prospective observational study, 25 female and male rowers were recruited within clubs in the “Association Romande d’Aviron” (ARA). During a measurement session participants’ anthropometric data was recorded, the participants’ strength, their aerobic and anaerobic capacity were also measured. Lower limb strength and power were measured with a countermovement and squat jump by means of an accelerometer. The anaerobic capacity was measured with a 30 seconds Wingate test on a rowing ergometer. So was the aerobic capacity with an incremental test. To further complete the data, two on-ergometer and two on-water performances measured during Swiss national competitions were extracted from published results.

**Results:** Twenty-five rowers (mean  $\pm$  SD: age  $17.4 \pm 2.4$  years; height  $1.78 \pm 0.07$  m; weight  $69.4 \pm 8.9$  kg; BMI  $21.9 \pm 2.2$  kg/cm<sup>2</sup>), 6 women and 19 men from different clubs were assessed. Significant correlations were found between rowing performances (on-ergometer speed (E); on-water rowing speed (R)) and physiological parameters, namely with maximal aerobic power (E:  $r=0.91$ ; R:  $r=0.63$ ), Wingate mean power (E:  $r=0.78$ ; R:  $r=0.60$ ), squat and countermovement and jump maximal strength (E:  $r=0.74$ ,  $r=0.83$ ; R:  $r=0.54$ ,  $r=0.48$ ) as well as with squat and countermovement jump power (E:  $r=0.73$ ,  $r=0.72$ ; R:  $r=0.63$ ,  $r=0.64$ ).

**Conclusion:** This study shows the relevance of the aerobic capacity, lower limb strength and anaerobic capacity for on-ergometer performances. For on-water performance, lower limb power seems to be the most important parameter followed by aerobic and anaerobic capacity. In order to optimize rowing performance, physiological parameters should be taken into account, with various importance depending on competition type, in training preparation and selection. More research is needed to confirm this result.

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# EEG technology for physiotherapists: fallacious or potential future? A usability study

**Background:** In recent decades, chronic pain has become a prevalent problem in industrialized countries, with estimates varying between 8 and 60% of the respective populations. Support to identify dominant central pain mechanisms and associated cortical markers in patients with chronic musculoskeletal pain disorders using an Electroencephalography (EEG) device is a key element of future clinical daily use of physiotherapists. The purpose of this study was therefore to analyse whether an EEG may enhance physiotherapists daily practice concerning diagnostic and treatment possibilities of patients with chronic pain.

**Methods:** This cross-sectional study investigates the usability of a wireless EEG device concerning data of effectiveness (task success), efficiency (task time) and satisfaction (System Usability Score). Subsequent to a training session, a sample of 12 physiotherapists performed a set of 12 tasks regarding installation, EEG signal acquisition and using the graphical user interface. Data were collected using predefined criteria and a maximum time limit, a stopwatch and questionnaires. Descriptive and inferential statistics were applied to the outcome measurements.

**Results:** In total, 69.2% of all tasks were completed successfully. In case of unsuccessful tasks, it was mostly due to being false or out of time. Successful task time varied between all task categories, particularly tasks of the installation process had long task times. Overall satisfaction was 62.7, which fits to "OK" on the adjective rating.

**Conclusions:** Although overall task success was high, particular tasks regarding the installation process had a low success rate. Long task times to install the EEG for a particular physiotherapeutic session prohibit its current clinical use no matter how successful the following tasks were solved. This might explain comparatively low satisfaction ratings. Further revisions of the wireless EEG regarding the therapy session installation process are of top priority before testing its effectivity in physiotherapeutic practice.

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# Measurement Properties of Assessments in Patients with the Overlapping Pathologies Cervicogenic Headache, Non-specific Neck Pain and Temporomandibular Disorders: a Systematic Review and Meta-Analysis

**Background:** The possible relationship between cervicogenic headache (CGH), non-specific neck pain and temporomandibular disorder (TMD) suggests the use of common measurement tools.

**Objective:** The aim was to evaluate the level of evidence (LoE) and the quality of measurement properties of the Neck Disability Index (NDI), flexion-rotation-test (FRT) and Passive Accessory Intervertebral Movement test (PAIM) in individuals with CGH, non-specific neck pain or TMD.

**Design:** Systematic review and meta-analysis.

**Methods:** Search in PubMed, CINAHL and EMBASE. The quality of the measurement properties and the LoE were evaluated by the approach proposed by the Consensus-based standards for the selection of health measurement instruments (COSMIN). For reliability and criterion validity, we modified the COSMIN approach and used a meta-analytical approach.

**Results:** The NDI showed positive reliability ratings of strong evidence in patients with non-specific neck pain and conflicting results in patients with chronic pain. Responsiveness and validity showed positive results with moderate to strong LoE. The FRT related to CGH showed a positive quality in reliability with limited and moderate LoE. The validity was partly undetermined except for criterion validity, which showed a positive rating with limited evidence. PAIM evidence of criterion validity in non-specific neck pain patients showed a positive result with limited evidence. No studies provided information about measurement properties regarding TMD.

**Limitations:** The NDI, FRT and PAIM were not evaluated in all three disorders.

**Conclusion:** It is suggested to use NDI in non-specific neck pain, FRT in CGH and PAIM in both pathologies for evaluating and diagnostic purposes. It is unclear whether the three assessments can be used as common assessments in all three disorders.

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# Joint position error after combined neck movements in the sagittal plane in healthy experienced computer workers: a cross-sectional study

**Background:** Neck pain is highly prevalent in office workers. Previous investigations assessed the cervical joint position error (JPE), reflecting proprioceptive functioning of the cervical spine in healthy subjects and neck pain patients, but conflicting results prevail. Since the upper cervical spine (UCS) shows stronger proprioceptive connections to the central nervous system compared to the lower cervical spine (LCS) and impairments especially in the UCS are associated with neck pain, JPE need to be tested separately in both cervical regions. The purpose of this study was to investigate the JPE after cervical pro-/retraction movements in healthy office workers, and evaluate the effect of vision, movement direction, region and gender.

**Methods:** Thirty healthy office workers equally distributed in male and female participated in this study. Each subject performed four test conditions with variations in vision and movement direction. Cervical JPE was assessed using the Kinect head tracker and was expressed in constant error (CE), absolute error (AE) and variable error (VE). A repeated measures ANOVA was conducted to evaluate the effect of vision, movement direction, region and gender on JPE.

**Results:** The UCS showed significant higher JPEs in VE (mean 2.14°) compared to the LCS (mean 1.75°) with  $p=0.035$ . Although not significant, both in CE and AE the UCS had a tendency of larger JPEs with  $p=0.076$  and  $p=0.057$  respectively. Subjects predominantly overshoot their starting position in both cervical regions. No effect of movement direction and vision on all error variables was found. Females showed a significantly higher JPE in AE variable in the UCS (mean 3.14°) compared to males (mean 2.38°) with  $p=0.045$  and demonstrated generally a larger JPE.

**Conclusion:** The UCS showed in CE, AE and VE a tendency of larger JPEs compared to LCS segments and females had generally a higher JPE. This study suggests that further investigations on cervical JPE in healthy subjects and neck pain patients need to distinguish between the UCS and LCS and take the factor of gender into account to gain a better understanding about the proprioceptive role of the cervical spine in the presence of neck pain.

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# Establishing a Database and Conducting a Meta-Analysis of Health Economic Studies of Physiotherapy- Related Interventions in Patients with Low Back Pain and Hip and /or Knee Conditions

**Objectives:** To establish a database and provide an overview of the current available evidence regarding health economic evaluation studies as used in physiotherapy. To report if there is a difference in monetary costs and health-related outcomes from a health care and societal perspective, between patients receiving physiotherapy interventions and those receiving usual care. If there is a cost difference, to report whether more expensive programs provide more value for money in terms of total incremental net benefit (TINB).

**Methods:** PubMed was searched from the earliest possible date until October 2015. No language restrictions were considered. To create the database, randomized controlled trials with a full and partial health economic evaluation were identified. Full economic evaluations that compared physiotherapy interventions with usual care were included for the meta-analysis. Eight trials of low back pain (LBP) and hip and/or knee conditions (HKC) respectively, with a total of 2084 participants, were included. Trial appraisal included the risk of bias assessment, and the quality of economic evaluation was analyzed using a quality of health economic studies (QHES) checklist. Study characteristics extracted include study population, health outcome measurement scales, cost and outcome of intervention and control group, costing year, and currency and follow up time. All costs were adjusted to the Euro currency 2016. Meta-analysis was conducted using the comparative efficiency research formula.

**Result:** Out of 737 papers retrieved from electronic search, 320 were considered eligible for inclusion in the database. Of these, 130 health economic evaluation studies were within the field of musculoskeletal physiotherapy. From a health care perspective, the meta-analysis showed that, for the management of LBP, with willingness-to-pay (WTP) of €50000, physiotherapy intervention provides a TINB of € 1515 (95% CI, €450 to €2580) in comparison to usual care. From a societal perspective, for the management of LBP, physiotherapy intervention yielded a reduced TINB of €792 (95%CI, -€2006 to €3589) in comparison to usual care. From a health care perspective, for the management of HKC, with a WTP of € 50000, physiotherapy intervention yielded a TINB of €1194 (95%CI, €711 to €1676) in comparison to usual care.

**Conclusion:** The meta-analysis shows that, physiotherapy intervention for the management of LBP and HKC, either alone or combined with usual care, provides more TINB, from the perspective of health care and society.

Betreuungsperson

Jan Taeymans, PhD

# Involuntary Activity of Pelvic Floor Muscles while Using Stairs, Rising from a Chair and Lifting Loads in Healthy Women – an Exploratory Pilot Study

**Introduction:** Activities of daily living (ADL) accompanied by increasing intra-abdominal pressure provoke urine loss in women with stress urinary incontinence (SUI). For preventing SUI involuntary pelvic floor muscle activity (IPFMA) is important. It is neither completely clear how IPFMA occurs on a neurophysiological level nor how it can be trained. The objective of this study was to examine whether there is IPFMA in stair use, rising from a chair and lifting loads.

**Methods:** Electromyographic (EMG) activity of pelvic floor muscles (PFM) of 16 healthy women was determined using vaginal probes while participants went up and down stairs, lifted loads and got up from a chair, with different weight and pace respectively. Root mean square (RMS) values of the EMG signals were analysed before and after onset of load. EMG values were normalised to the peak activity during maximum voluntary contractions (%MVC). Differences were detected using paired t-test, ANOVA for repeated measures and post-hoc t-test ( $\alpha < 0.05$ ).

**Results:** Stair up and down showed long lasting activity of PFM, tendentially increasing (66.2- 152.1 %MVC) with increased pace. Load lifting (159.1-194.1 %MVC) and chair rise (86.7-94.2 %MVC) also showed higher activity with increasing weight and pace respectively.

**Conclusion:** The results demonstrated IPFMA during stair use, lifting loads and rising from a chair. These ADL can presumably be used to activate the involuntary pelvic floor response. Further research on IPFMA in women who suffer from SUI would be needed to differentiate possible pathological changes of the IPFMA and to improve training concepts with focus on IPFMA.

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## Effects of a forefoot oriented exercise intervention on jumping performance in volleyball players: a randomised controlled intervention study

**Objectives:** The aim of this study was to investigate the effects of a 12-week forefoot oriented exercise intervention on jumping performance in male and female volleyball players.

**Design:** Multicentre, randomised, controlled intervention study.

**Methods:** A total of 93 (age  $24.2 \pm 4.6$  y) volleyball players with a similar training load and competitive background were randomly assigned to an intervention group (IG;  $n=42$ ) performing a 15-min forefoot oriented intervention during their warm-up procedure for 12 weeks or a control group (CG;  $n=51$ ) continuing their usual program. Athletes were evaluated for jumping using squat jump (SJ) and countermovement jump (CMJ) tests before and after intervention. Two-way repeated measures analysis of variance (ANOVA) was conducted to examine interaction effects (group x time) on jumping performance.

**Results:** The CG showed improvements in SJ of  $1.6 \pm 3.5$  cm ( $5.5\% \pm 12.0\%$ ) and CMJ of  $0.6 \pm 3.5$  cm ( $1.9\% \pm 10.9\%$ ). The IG showed improvements in SJ of  $1.1 \pm 3.8$  cm ( $3.6\% \pm 12.6\%$ ) and a decline in CMJ of  $-0.5 \pm 7.1$  cm ( $-1.5\% \pm 21.2\%$ ). ANOVA showed no significant interaction effects for SJ ( $p=0.535$ ) and CMJ ( $p=0.297$ ). Within subject tests indicated a significant time effect for SJ ( $p=0.001$ ), but no significant group effect ( $p=0.560$ ). In CMJ no significant main effects were found.

**Conclusions:** Performing the 12-week forefoot intervention did not significantly influence jumping performance in volleyball players. Higher training stimuli may be needed to improve jumping performance in volleyball players.

Betreuungsperson

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## Comparison of spinal gait kinematics among different sling-based carrying techniques

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Infant carrying in a sling is a common task in mothers and mothers are often seen in the physiotherapy practice due of back pain. The purpose of this study was to investigate the changes of the spine in different methods of infant carrying in a sling during standing and walking. Fifteen female persons ( $27 \pm 8$  years) participated in this study in four different modes: “without load”, “dummy in front”, “dummy on preferred side” and “dummy on not preferred side”. For each mode a standing and walking trial was conducted and three dimensional movement of the spine was measured. For the carrying modes a 6 kg heavy dummy was used. Lumbar curvature when walking showed a significant increase in all carrying conditions (front:  $58.4^\circ$ ,  $p=0.000$ ; preferred:  $51^\circ$ ,  $p=0.007$ ; not preferred:  $46.4^\circ$ ,  $p=0.028$ ) compared to the no load condition ( $41.8^\circ$ ). Furthermore there was a significant change in the thoracic curvature between no load (stand:  $40.9^\circ$ ; gait:  $41.1^\circ$ ) and the preferred side condition (stand:  $45.9^\circ$ ; gait:  $46.3^\circ$ ) when walking ( $p=0.000$ ) and standing ( $p=0.000$ ). Range of motion of the pelvis during gate decreased in all carrying conditions (front:  $7.3^\circ$ ; preferred:  $8.4^\circ$ ; not preferred:  $8.1^\circ$ ) compared to the no load condition ( $13.1^\circ$ ,  $p=0.000$ ). Generally it can be concluded that carrying an infant does have an impact on spine position and movement but the differences between the different carrying conditions are not statistically significant. Due this findings it can be supposed that it may not matter in which carrying position the mother carry her infant.

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# A retrospective evaluation of gait alterations in children and adolescents with cerebral palsy after multilevel surgery

The purpose of this study was to investigate a retrospective evaluation of gait alterations after single event multilevel surgery (SEMLS) in children and adolescents with bilateral cerebral palsy (CP). To compare the three dimensional instrumented gait analysis of twelve patients with twelve healthy control subjects, we conducted a principal component analysis (PCA). The PCA was used to reduce kinematic and kinetic gait data and to detect gait differences. The differences between pre- vs. postoperative analysis and control group vs. postoperative patient group were calculated through a linear mixed model (LMM). Patients after SEMLS walked with smaller internal foot progression angle and reduced knee adduction throughout the gait cycle (GC). Retained gait deviations showed an excessive pelvic tilt, persisted internally rotated and flexed hip over the entire GC. The range of motion of knee and ankle was reduced in the sagittal plane and a time delay in the sagittal ankle pattern were present. According to the retained unfavourable pelvic tilt position, we deduced the necessity of intensive physical therapy postoperatively. Gait analysis should support postoperative after care and future studies are necessary to focus on the effect on gait deviations after SEMLS.

### Betreuungsperson

Regina Wegener, PhD



# Effects of a forefoot oriented exercise intervention on injury incidence in volleyball players: a randomised controlled intervention study

**Objectives:** Acute injuries of the lower extremity, in particular ankle injuries, are the most common injuries in volleyball players. Research in running sports has shown that forefoot running can reduce sports related injuries. The current study investigated if potential benefits of forefoot running technique may be transferable to team sports with a forefoot oriented movement pattern (e.g. volleyball).

**Design:** This study was conducted as a randomised clinical trial.

**Method:** This multicentre study included 171 Swiss and Belgium volleyball players from 22 different teams. The study was conducted from August 2016 until April 2017. All players with a habitual rearfoot running strike pattern were randomly allocated either to the control or the intervention group by equal block-randomisation in groups of four within each team. Players in the intervention group followed a prescribed forefoot oriented exercise intervention program (2-3x/week, 15 minutes) during warm-up for 12 weeks. Players of the control group followed their usual warm-up habits. After the intervention period, teams were observed for another 12 weeks. Coaches recorded volleyball exposure on a weekly basis for each player. Injuries were reported by the players themselves.

**Results:** Overall 56 injuries were registered. 36 (64.3%) were lower extremity and seven (12.5%) were ankle injuries. Twenty-five lower extremity injuries occurred during the intervention period and 11 during follow-up. No significant differences were found between the control and intervention group regarding new lower extremity and ankle injuries during the intervention, follow-up, and/or overall period.

**Conclusions:** Forefoot oriented exercise intervention is not effective for prevention of lower extremity or ankle injuries in volleyball players.

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# Reflex Activity of Pelvic Floor Muscles during Drop Landings and Mini Trampolining – Exploratory Study

**Introduction:** Complex functional movements like jumping typically provoke stress urinary incontinence (SUI) in women. The aim of this study was to investigate pelvic floor muscle (PFM) activity in young, healthy women during drop landings and mini trampolining and thereby explore activity characteristics of the PFM during jumps.

**Methods:** Surface electromyography (EMG) from PFM was measured in 16 healthy women with a tripolar vaginal probe during drop landings from heights of 15, 30 and 45 cm as well as during mini trampolining with 75 and 90 jumps per minute. Time of foot strike and ground reaction force (GRF) was determined by force plates. Root mean square values of the EMG signals were analysed from 30 ms before to 150 ms after foot strike. Peak activity during maximum voluntary contraction (MVC) was set as 100% for EMG normalisation. PFM ON threshold was determined as the mean of rest activity plus 2 standard deviations. Statistical analysis was examined with Friedman and Wilcoxon tests.

**Results:** Mean pre- and reflex activity increased significantly with jumping height and jumping frequency ( $p < 0.05$ ). EMG activity during all jumps was significantly above the PFM ON threshold. Drop landings triggered peak PFM activity between 34 and 44 ms after foot strike (115–182% MVC), whereas on the mini trampoline peak PFM activity was reached at 133 ms (85–115% MVC).

**Conclusion:** Intensity of PFM reflex activity depends on how fast the GRF rises during foot strike. Like running, jumping could be established for future PFM diagnostics or training methodology.

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