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Zürcher Hochschule
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Institut für
Physiotherapie

Abstracts 2013

Masterarbeiten Master of Science in Physiotherapie (MScPT) Studiengang 2010

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Editorial

Sehr geehrte Leserin, sehr geehrter Leser

Sie halten die Sammlung der Abstracts der Masterarbeiten des ersten Studiengangs Master of Science in Physiotherapie (MScPT) der Schweiz in den Händen. Diese ersten Absolvierenden bewiesen mit ihrer Anmeldung zum Studium im 2010 viel Vertrauen sowohl in den neuen Studiengang als auch in sich selbst.

Nun sind drei Jahre vorbei und mit grosser Freude präsentieren wir Ihnen die Zusammenfassungen der Masterarbeiten. Diese geben einen Eindruck von der Breite der Themen und Fragestellungen in der Physiotherapie-Forschung. In den Masterarbeiten haben die Studierenden relevante Fragestellungen aus der klinischen Praxis wissenschaftlich bearbeitet. Die daraus folgenden Ergebnisse und Antworten können nun in der Klinik genutzt werden und helfen damit den Gap zwischen Theorie und Praxis zu überbrücken. Die meisten Masterarbeiten sind bereits im Verfahren zur Publikation in einer deutsch- oder englischsprachigen Fachzeitschrift. Mehrere Abstracts sind schon zur Präsentation an internationalen Kongressen akzeptiert. Das ist eine grossartige Leistung der Absolvierenden, die damit auch den letzten wichtigen Schritt in einem Forschungsprojekt erleben, nämlich den Effort, die eigene Forschungsarbeit zu publizieren und zu präsentieren und schliesslich das Hochgefühl, wenn das Ziel nach einem langem Arbeitsprozess erreicht ist.

Das Erreichte ist aber auch ein Erfolg für den Studiengang MScPT, und dieser wäre nicht möglich ohne die Mitarbeit und die Unterstützung von vielen Personen. Dieses Büchlein ist damit auch ein besonders herzlicher Dank an sie alle: besonders an die Dozierenden, welche den Lernstoff kompetent und engagiert vermittelten und an die Mentorinnen und Mentoren, welche die Arbeiten betreuten; aber auch an die Vorgesetzten, an die Kolleginnen und Kollegen in Forschung und Klinik und an die Familien und Freundinnen und Freunde, sie alle unterstützten und begleiteten die Studierenden während ihrer Studienzeit.

Nicht zuletzt aber ist diese Abstractsammlung eine wichtige Etappe für die weitere Entwicklung der wissenschaftlichen und klinischen Physiotherapie in der Schweiz. Die Autorinnen und Autoren der Masterarbeiten haben einen vielversprechenden ersten Schritt in diese Richtung gemacht.

Wir wünschen Ihnen eine spannende und inspirierende Lektüre!



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German translation, cross-cultural adaptation and validation of the STarT back screening questionnaire

Background: Effective treatment for acute low back pain to prevent chronicification remains a challenge. Psychosocial risk factors play a crucial role. Evidence exists for the importance of subgroup targeted treatment, which depends on adequate screening tools. Because of lack of handy, valid and reliable tools, the STarT back questionnaire was developed. **Aim:** The aim of this study was to translate and cross-culturally adapt STarT into German and to test the translated version (STarT-G) for psychometric properties. **Methods:** The translation was performed according to internationally accepted guidelines. A linguistic analysis checked for Swiss German idiosyncrasies. Pretests to verify comprehension and acceptability were carried out in Switzerland and Germany. 50 physiotherapy patients in Switzerland filled out a booklet containing STarT-G, 5 reference standard questionnaires (RMDQ, HADS, PHQ-2, TSK and PCS) and single questions. The psychometric validation explored the internal consistency of the psychosocial subscale, the convergent and divergent construct validity, floor and ceiling effects and the discriminative ability using an AUC-analysis. **Results:** The translation process was straightforward. The linguistic check revealed no Helvetisms. The pretests showed good comprehension and acceptability both in Switzerland and Germany. Item 5 (fear avoidance beliefs) manifested some ambiguities. While demographics were close to the original study, baseline characteristics were different. Cronbachs alpha for the psychosocial subscale was 0.53. Spearmans rank correlations for convergent construct validity ranged from 0.35 to 0.56. 'Case' / 'no case'- distribution in the divergent construct validation showed clear distinction for the 'No cases'. AUCs for discriminative ability were 0.79 - 0.91. Neither floor nor ceiling effects were found. **Discussion:** STarT-G is linguistically valid for all German speaking areas. Reasons for item 5 ambiguities were probably due to the specific construct and not to the translation and adaptation process, as this happened as well in the Dutch translation as in the original study. Acceptable validity coefficients were found. The poor internal consistency could be due to baseline scores and the lack of high risk patients. AUC showed satisfying discrimination. **Conclusion:** This study provides for the first time data on psychometric properties for a fast and easy screening tool for German speaking patients with acute low back pain. The strength of STarT-G is to tackle selectively modifiable risk factors. In our opinion the instrument can be used in practice, but until further research investigates the reliability, results should be interpreted conservatively. A subsequent large scale study is under way.

Gait deviations and compensations in patients with coxa antetorta

Coxa antetorta mainly appears as a cosmetic problem and is treated only in severe cases and in the presence of physical complaints. For therapy only surgery is effective. Coxa antetorta is assumed to induce alterations in the leg's mechanical axis and may stress adjacent joints. The purpose of this study was to examine the effect of coxa antetorta on kinematics and kinetics and to separate these gait deviations into primary and secondary deviations. Based on three-dimensional gait analysis (3DGA) a retrospective, cross sectional study was conducted to detect gait deviations in adolescents ($n = 15$) with coxa antetorta in comparison to controls ($n = 13$). Principal component analysis was applied as a preliminary step to achieve data reduction. Linear mixed models applied on PC-scores were used to estimate the main effects within retained principal components (PCs). Group effects of PC-scores showed that patients walked with less external foot progression angle, more external ankle rotation and knee varus, more internally rotated and flexed hips and more anterior pelvic tilt. Patients showed a lower knee adduction moment in two PCs and a lower hip adduction moment in one PC. Differentiation in primary and secondary deviations was derived from clinical considerations. In summary coxa antetorta affects joint kinematics and kinetics, which may cause physical complaints and may accelerate osteoarthritis in future. These gait deviations have to be considered in individual clinical decision-making. For planning surgical corrections we, therefore, recommend conducting 3DGA in patients with coxa antetorta, additionally to considerations of clinical examination.

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Development and validation of an Android®-based measurement tool for the quantification of the Sit-to-Stand movement

Introduction: Physiotherapists increasingly need to measure physical parameters of their patients. Measuring the risk of fall in elderly is currently a very important challenge that can save many people from physical and psychological traumata, as well as save a high amount of health care costs. Latest studies showed that biomechanical parameters may provide early information about the risk of fall in seniors and many authors indicate that Smartphone (SMP) incorporated accelerometry may play an important role in solving this problem. Thus, the purpose of this study was to develop and validate an Android®-based application (App) for smartphones, which quantifies the sit-to-stand movement.

Methods: The App was developed to measure the maximal produced force (F_{max} [N/kg]), the rate of force development (RFD [N/kg/s]), the maximal generated power (P_{max} [W/kg]) and the total STS duration (T_{total} [s]). Twenty subjects were recruited for its validation. The subjects were asked to stand up from a custom-built chair, while wearing 36 reflective markers and a SMP on which the App was running. The Sit-to-Stand (STS) movements were performed with the SMP at two different locations (L3 and sternum) and were also recorded by two force plates. After data processing, the relative (ICC) and the absolute (SEM) reliability were calculated, as well as the concurrent validity (pearson's r) in variables presenting an $ICC \geq 0.75$. The absolute validity was also calculated through paired t-tests between the SMP and the force plate derived mean values. The "minimum amount of trials needed" to achieve ICC level of ≥ 0.75 was determined.

Results: Fifteen subjects were included into the data analysis. The results presented ICC values ranging from 0.33 to 0.97 and correlations of $r = 0.76-0.99$. Most of the variables achieved or exceeded the reliability threshold of $ICC \geq 0.75$. However, RFD did not and was therefore not further analyzed for validity. The minimum amount of trials needed was found to be four in L3 and three in sternal trials.

Conclusion: The developed App is able to provide reliable and valid data about F_{max} , P_{max} and T_{total} of a subject performing the STS movement, if the recommended protocol is followed. However, further research about the transfer into the clinical setting is needed in order to validate the present tool for clinical use.

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Reliability of a Protective Reaction Assessment

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Background: The incidence of accidental falls in elderly people is constantly increasing. One of the strategies to prevent falls is Protective Reactions like side- or cross-steps. To date, an assessment which systematically evaluates and interprets the Protective Reactions in elderly people does not exist.

Objective: This study verifies the reliability of the already validated Protective Reaction Assessment (PRA) with its 10 items.

Method: A cross-sectional study with 30 subjects, all over 70 years old, was carried out. The PRA was done twice and videotaped. Videos were evaluated by six independent physiotherapists who made a re-evaluation of the videos 4 weeks later. The intrarater-, the interrater- and the test-retest-reliabilities of the items were estimated with Fleiss' kappa and weighted kappa, those of "PRA total" as a total score with the intra class coefficient ICC (1.1), under the assumptions $K \geq 0.5$ (95% CI > 0.2) and $ICC > 0.6$.

Results: Intrarater-reliability turned out to be moderate ($K \geq 0.5$) in 6 of 10 items; the ICC of "EPR total" was sufficient with a value of 0.65. Interrater- and test-retest-reliability were in the majority of cases weak ($K < 0.5$).

Conclusion: The results of the intrarater-reliability show that the Assessment can be used to measure the Protective Reactions. Further studies including improved standardized training in testing and rating should be done to improve the results of the interrater- and the test-retest-reliability.

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Validity and reliability of the OptoGait system for quantification of gait parameters – and its practicability

The OptoGait system is a floor-based photocell system for measuring spatiotemporal gait parameters. The purpose of this study was to investigate the relative and absolute reliability as well as concurrent and discriminant validity of the 5-meter OptoGait system testing healthy participants and patients with limping gait pattern. The proband's gait was measured simultaneously by the OptoGait system and the GAITRite® walkway. The gait parameters such as step length, stride length, walking speed, single and double support, stance phase and step time were derived from both devices. Twenty-four healthy and Twenty-three patients performed three walking trials at a individually set speed. Test interval was five minutes. All variables showed excellent relative reliability (ICC 3,1 = 0.88 to 0.98). The smallest detectable changes of all gait parameters were smaller than 9.63% of the mean value. The Bland-Altman plots revealed no systematic errors and all variables showed a tendency towards homoscedasticity. The concurrent validity showed excellent agreement between the devices (ICC 2,1 = 0.95 to 1). The OptoGait system demonstrated high discriminant validity ($p<0.01$). It delivered reliable and valid data of spatiotemporal gait parameters. Hence the study came to the conclusion that the OptoGait system is a simple, quick and objective measurement tool with respect to other computer supported gait analysis tools for patients in clinical settings.

The expectations of patients with trapeziometacarpal osteoarthritis (TMC OA) and possible determinants of the fulfillment of these expectations

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Purpose: The aim of this study is to assess the reason why patients aimed to be treated for their trapeziometacarpal osteoarthritis (TMC OA) as well as the patients' expectations prior to treatment and the expectation fulfillment at three and twelve months after treatment initiation. Possible determining factors are calculated for expectation fulfillment.

Methods: A prospective cohort study is conducted with patients seeking treatment for TMC OA at Schulthess Klinik and providing informed consent. The participants fill in a questionnaire at baseline assessing the reason for seeking treatment and their expectations prior to treatment. Together with a surgeon they decide on a surgical or conservative intervention. After three and twelve months another questionnaire is filled in to determine the expectation fulfillment. The severity of symptoms is assessed with the Michigan Hand Outcomes Questionnaire at baseline, three and twelve months.

Results: Complete data sets of 77 patients were collected at the time of statistical analysis. Pain reduction is reported as the most important (63%) reason for seeking treatment followed by an improvement of the hand function (19%). Fulfilled expectations are reported by 53.2% of all patients at twelve months, while only the surgery group shows values over 50% at three and twelve months. Regression models show that expectation fulfillment is mostly determined by the outcome treatment success and "prior expectations" and "expected remaining pain" have only a minor predictive value. Patients' whose baseline expectations are not fulfilled at twelve months (defined as expectation-actuality discrepancy) show significantly higher baseline expectations, elevated expected remaining pain and no improvement of symptom status compared to the group with fulfilled baseline expectations at twelve months.

Conclusion: A majority of the participants report their expectations of pain reduction and improvement of hand function to be fulfilled after twelve months. Expectation fulfillment is mostly determined by the treatment success and not by initial expectations. Future research on expectation-actuality discrepancy should be performed since it could reveal exaggerated baseline expectations having an impact on the outcome. The results can be useful for patient guidance and education.

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Validity and reliability of myotonometric assessment of lower limb muscles in chronic stroke patients

Background: There is no valid and practical instrument for the assessment of skeletal muscle impairments in stroke patients. The MyotonPRO is a portable instrument that has the potential to provide an objective evaluation of muscle mechanical properties in clinical settings. The aim of this methodological study was to examine the validity and test-retest reliability of MyotonPRO for the assessment of muscle stiffness, tone and elasticity in the main lower limb muscles of chronic stroke patients.

Methods: Twenty stroke patients and twenty healthy subjects matched for age and sex had thigh and ankle muscles evaluated with (1) MyotonPRO for muscle stiffness, tone and elasticity, (2) ultrasonography for muscle and subcutaneous thickness, and (3) dynamometry for isometric muscle strength. First, MyotonPRO variables were compared between sides, groups and sexes. Second, MyotonPRO parameters were correlated to dynamometric and ultrasonographic outcomes. Third, MyotonPRO test-retest reliability was investigated.

Findings: MyotonPRO variables did not differ between the more affected and the less affected side of patients, and neither differed between patients and controls. Thigh muscle stiffness was significantly negatively correlated to subcutaneous thickness ($r=-0.84$ for the vastus lateralis), while only tibialis anterior stiffness and tone correlated positively with muscle thickness ($r=0.46$). Test-retest reliability of MyotonPRO parameters was acceptable, except for muscle elasticity.

Interpretation: Even though MyotonPRO reliability was acceptable for the evaluation of lower limb muscle properties in chronic stroke patients, its validity is seriously challenged by the poor discriminant ability and by the considerable impact of subcutaneous tissue thickness (sex-dependent) on the different mechanical parameters, particularly for thigh muscles.

Test-Retest Reliability of Postural Control Tasks in Healthy Subjects and Patients with Non-specific Low Back Pain

Background: Patients with non-specific low back pain (LBP) represent a heterogeneous subgroup of LBP. For applying specific therapy, classifications in subgroups are crucial. One possible movement disorder of this subgroup is poor postural control (PC). Therefore, assessing PC performance in these patients is essential. Reliability of standing PC tasks has been evaluated with force plates and 3D motion capture systems while it has not been tested with inertial measurement units (IMUs). The aim of this study is to assess intra- and intersession reliability of PC tasks measured with IMUs.

Methods: Within each of two sessions (1-4 days apart), 24 healthy subjects and 16 patients with non-specific LBP performed 3 trials of 3 standing PC tasks (hard surface/eyes open; hard surface/eyes closed; foam-plate/eyes closed). Two wireless IMUs were applied on the spinal processes of the second sacral and the first lumbar vertebra to measure movements of the lumbar spine. Mean position (MP), number of times crossing MP, mean deviation from MP, mean velocity (MV), peak velocity and range of movement (RM) were calculated for the sagittal (flexion/extension; XS) and frontal plane (lateral flexion; XF). XSF refers to both planes. The healthy subjects', the patients' and the overall samples were statistically analysed. Systematic bias, intraclass correlation coefficients (ICC), standard errors of measurement (SEM), %SEM, and the smallest real difference were evaluated.

Results: Intra- and intersession analysis showed wide ranges of ICC values (ICC 0.00 to 0.99) in all samples. Systematic bias was present in 5.6% of the parameters (healthy subjects and patients). The eyes-closed task (hard surface) showed highest medians of ICC values in all samples. MPS showed highest ICC values in all samples and comparisons (moderate to very high correlations).

Conclusion: The eyes-closed task (hard surface) measured with IMUs is recommended as reliable for assessing intersession-PC. Within this task MPS, MDSF, MVSF and RMSF proved to be reliable in the overall sample. MVSF showed high correlations in both, the healthy subjects' and the patients' samples. In general MPS proved to be the most reliable variable. However, absolute reliability showed large measurement errors, IMUs cannot detect small differences in PC performance.

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Reliability of Stiffness- and EMG-Measurements during Cervical Traction Applications in Healthy Subjects – a Pilot Study

Objectives: (1) To assess the intra-session and inter-session test-retest reliability (IaSTRR, IrSTRR) and feasibility of normalized surface electromyography (sEMG) in % of maximally voluntary isometric contraction (MVIC%) of the upper trapezoid muscle (UTM), the sternocleidomastoid muscles (SCM) and the cervical extensors (CEM) at rest and during cervical traction (CT) at a pressure (p) of 1 and 2 bar. (2) To assess IaSTRR and IrSTRR and feasibility of stiffness (k) - measurements of the cervical spine by TrakSTAR™ and instrumented Cervical Stretcher (CS) during CT at 1 and 2 bar, to guide the planning of a large-scale investigation in symptomatic subjects.

Research design: Observational, cross sectional pilot study with repeated measures (2 days, 6 trials, 3 repetitions).

Methods: Eighteen healthy subjects completed three CT's with the Cervical Stretcher (CS) at 6 different time points. sEMG assessed muscle activity (MA) and both TrakSTAR™ and iCS assessed k-measurements at 0, 1 and 2 bar. The tests were repeated one week later. Mean, SD ANOVA, ICC_{2,1}, standard error of measurement (SEM), and minimal detectable difference (MDD) were calculated for IaSTRR and IrSTRR. For single ICC interpretation criteria of Shrout and Fleiss (1979), for Fisher z transformed means ICC interpretation criteria of Currier (1990) were used.

Main results: All single ICC's of normalized sEMG during IaSTRR ranged between 0.07 and 0.99. ICC means ranged 0.61 – 0.92. Single ICC's of IaSTRR of k measurements ranged 0.23 - 0.85. ICC means ranged 0.51 (95%CI: 0.43 - 0.60) - 0.62 (95%CI: 0.53 - 0.70). ICC's of IrSTRR of sEMG varied -0.23 to 0.92. ICC means varied -0.07 (95%CI: -0.10 - -0.04) to 0.86 (0.73 - 0.99).

Conclusion: IaSTRR showed poor to excellent reliability results for MA measurement indicating feasibility. k- Measurements showed poor reliability and feasibility. IrSTRR showed poor feasibility for SCM-l at all p-levels, UTM-r at 0 and 1 bar and CEM-l at 2 bar. All other IrSTRR MA measurements and k-measurements were poor to not reliable and therefore not feasible. IrSTRR improved by using trial means, resulting in changed feasibility for UTM-r at 2 bar, and SCM-r at 1 bar and SCM-l at 0 bar. Over-generalization of interpretations of the results associated with the multiplicity of analyses and outcomes presented in this study must be considered.

Assessing Safety, Feasibility and Acute Effects of the Cervical Stretcher on Distraction of the Cervical Spine in Healthy Subjects – a Pilot Study

Background: Neck pain is very common and accounts for 15% of all soft tissue problems with a lifetime prevalence of seventy-one percent. Cervical traction is often recommended as part of the treatment of neck pain patients. Several studies assessed home based cervical traction devices and reported good results, especially for neck pain patients with radiculopathy. A new pneumatic home-based cervical traction device, the Cervical Stretcher (CS), was designed by Curaceras GmbH, Alpnach Dorf, Switzerland. In this study, the safety, feasibility and acute effects of the CS on distraction of the cervical spine were assessed.

Methods and design: This study was an explorative, experimental pilot study on twenty healthy subjects, recruited out of the body of the Bern University of Applied Sciences (BUAS). Change in stiffness and change in muscle activity before and after two different intervention settings (intermittent and continuous traction) were evaluated with a new electro-magnetic traction device, the TrakSTAR™ and Electromyographie (EMG) respectively. Repeated measures analysis of variance with Bonferroni-adjusted post hoc comparisons were performed to assess change of stiffness at six different time-points for both intermittent and continuous intervention and Friedmann-tests with Bonferroni-adjusted pairwise comparisons were performed for three different muscles on both sides of the neck. Safety and feasibility of traction, administered using the CS, were collected with the Numeric Rating Scale (NRS) and two self-constructed questionnaires.

Results: No statistically significant changes of stiffness between the six time-points were found for both intermittent and continuous traction. Although not at all time points significant, a tendency towards a decrease in muscle activity between the time points before intervention and immediately after intervention and a tendency towards an increase of muscle activity between immediately after intervention and later time points was seen. NRS and symptoms questionnaire revealed no adverse events.

Discussion: The results of the NRS and symptom questionnaire showed, that the CS can be applied safely on a healthy population. Although traction intervention with the CS appears to be feasible, adjustments in design of the CS might improve the function and efficacy of the CS.

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Mechanics of the femoropatellar joint: How are cartilage stiffness and subchondral bone strength associated?

Background: Disorders in the femoropatellar joint, such as the patellofemoral pain syndrome (PFPS) affect about 10-25% of the total population. PFPS is generally treated with non-operative methods, as these treatments are accepted to have a positive effect on PFPS. Yet, the literature data reported on the effectiveness of non-operative treatments are conflicting or showed inconsistent benefits for patients. Nowadays a better understanding of the pathomechanisms is expected to contribute to a better evaluation of the specific methods and eventually to a better treatment of PFPS patients. The present study contributes to this understanding, by identifying possible interrelations between cartilage stiffness and subchondral bone strength in normal porcine patellae.

Materials/ Methods: Eight porcine patellae were analyzed. Determination of dynamic modulus E^* and loss angle δ of articular cartilage was based on mechanical indentation testing methods, followed by mathematical modeling. Bone density and strength were measured using CT-OAM density scans and invasive indentation test procedures.

Results: Bone density and bone strength showed significant higher values in the central part of the patella and displayed a moderate positive correlation. In contrast, the AUC distribution showed higher values in the peripheral area. In cartilage E^* was higher in the central part, whereas the loss angle showed no distribution variation in function of anatomic location. Correlations were neither found between bone strength and dynamic modulus E^* , nor between bone strength and loss angle.

Discussion/ Conclusion: The patterns found for bone strength and density and the positive correlation between these two parameters, are interpreted to result from long term high load in the central part of the patella. The higher E^* values are due to higher deformation rates in the central part of cartilage. The lack of a similar pattern in the loss angle is proposed to result from an intact proteoglycan structure in the cartilage. Overall, the results of the present study advocate that a better understanding of the mutual interrelation between the tissues of the femoropatellar joint is needed for a better assessment of the pathomechanisms and finally an improved treatment of PFPS patients.

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Sensorimotor Tests such as Movement Control and Laterality Judgment Accuracy in Persons with Recurrent Neck Pain and Controls. A Case-Control Study.

Background: Assessing sensorimotor abilities and movement control becomes increasingly important for classification and management of patients with neck pain, because of the potential contribution to the development of chronic neck pain.

Objective: Our objective was to evaluate whether sensorimotor tests could discriminate between persons with and without neck pain and to assess correlations among all assessments.

Design: A matched case-control study with 30 persons with recurrent neck pain and 30 controls was conducted.

Methods: We tested two-point discrimination (TPD), joint position error (JPE), muscle activation with the craniocervical flexion test (CCFT), laterality judgment accuracy and movement control (MC). And we administered the Fear Avoidance Beliefs Questionnaire (FABQ), the Neck Disability Index (NDI) and the painDetect questionnaire.

Results: According to the areas under the curve (AUC), tests for JPE (0.73), CCFT (0.73), MC (0.83) and laterality judgment accuracy (0.68) were able to discriminate between persons with and without neck pain. Among the five tests, moderate correlations were found between TPD and CCFT, as well as among laterality judgment accuracy and JPE and MC (r between -0.4 and -0.5).

Limitations: The small sample size did not allow comprehensive multivariable calculations. The same examiner performed all tests. However, this person was not aware whether the participants were cases or controls for most participants.

Conclusion: We recommend the assessment of various aspects of sensorimotor ability and of central representation of the body schema even in patients with mild neck pain. Especially, for clinical practice we recommend the craniocervical flexion test, testing of laterality judgment accuracy and three movement control tests (cervico-thoracic extension, protraction-retraction of the head and quadruped cervical rotation).

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Effect of Stochastic Resonance Whole Body Vibration on Strength in the Frail Elderly – a Pilot Study

The aim of this pilot study was to evaluate the feasibility and the effects of 4-week stochastic whole body vibration (SR-WBV) training on functional performance and strength in frail elderly individuals. 27 participants have been recruited and randomly distributed in an intervention group (IG) and a sham group (SG). Primary outcomes were feasibility objectives like recruitment, compliance and safety. Secondary outcomes were short physical performance battery (SPPB), maximum isometric force (Fmax) and rate of force development (RFD). The intervention was feasible and safe. Furthermore it showed significant effects ($p = .035$) and medium effect size (.43) within the IG in SPPB. SR-WBV training over 4 weeks with frail elderly is a safe intervention method. The compliance was good and SR-WBV intervention seems to improve functional performance. Further research is needed with modification of the study protocol to probable detect intervention effects also in the force measurements.

What about neurodynamics? Relationship between the straight leg raise, muscle strength and motor performance in children with cerebral palsy

Neurodynamics is a well-established physiotherapeutic concept to improve mobility impairment in adults with neurological disorders. Children with cerebral palsy (CP) are affected by restrictions of range of motion. These restrictions can lead to limitations in daily movement. Therefore, this study sought to determine whether neural structures could be involved in restricting lower limb movements. We hypothesized that a positive straight leg raise (SLR) could relate to lower muscle strength, reduced motor capacity and less motor performance in children with CP. Additionally the reliability of the SLR was assessed.

Twenty-three children with CP (6-18 years) participated in this cross-sectional study with repeated SLR measurements. We performed the SLR, muscle strength testing of the leg muscles with a hand-held dynamometer, the gross motor function measurement (GMFM-66) and a quantification of daily activities using a 3D accelerometer.

The SLR could distinguish well between children with low versus high muscle strength as well as functional capacity. In this study a restriction in neural structures could be related to the functional status of these children. Contrary, the SLR hip range of motion correlated fairly to poorly with the functional measurements. A very good intraclass correlation coefficient (ICC 0.83 to 0.93) indicated good inter-rater reliability for the SLR in children with CP.

Overall the SLR might provide additional information for clinical reasoning and treatment goal setting in children with CP. The SLR is a reliable assessment tool to evaluate restrictions in the range of motion of the lower limbs due to neural impairments in children with CP. Further studies should investigate if improving neural mobility can lead to an amelioration of function in children with CP.

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Reliability and validity of pelvic floor muscle displacement measurements during voluntary contractions and reflex activity

Objective: Understanding the processes and mechanisms involved in the functioning of pelvic floor muscles (PFM) is crucial in therapy regimens for female pelvic floor dysfunctions. To date, no measurement tool exists that measures the pelvic floor muscle displacement (PFMD) during dynamic functional whole body movements. The aim of this study is to determine the reliability and validity for quantifying voluntary contraction and reflex activity of PFM with an electromagnetic tracking system (ETS).

Methods: This cross sectional observational study examined the PFMD of 17 young healthy nulliparous women. During the single measurement session maximal voluntary contractions (MVC) and quick flicks (QF) were simultaneously examined with ETS and trans-abdominal ultrasound (US). Reflex activity of PFM was measured during trampoline jumps with the ETS. To evaluate intra-session test-retest reliability and validity the mean, SD, ANOVA, ICC (2,1), SEMTS, SEP, and MDD were calculated.

Results: Intraclass correlations showed the MVC in supine by ETS=.81, US=.50 and ETS-US=.37, MVC during standing: ETS=.87, US=.50, ETS-US=.20, QF in supine: ETS=.89, US=.62 and ETS-US=.12, QF during standing: ETS=.79, US=.57 and ETS-US=.24 and during trampoline swings: ETS=.15 and jumps: ETS=.19.

Conclusions: ETS measurements are highly reliable for all voluntary contractions however not during trampoline jumps. US measurements are moderately reliable. The correlation between the US and ETS measurements is low. Further investigations are necessary to validate PFMD measured by ETS. Additionally reproducibility needs to be investigated, in dynamic functional whole body movements. ETS seems to be a reliable measurement tool to evaluate PFMD during voluntary contractions.

Content Validity of the Work Rehabilitation Questionnaire-Self-Report Version WORQ-SELF in a Subgroup of Spinal Cord Injury Patients

Objective: The Work Rehabilitation Questionnaire-Self-Report Version (WORQ-SELF) is an assessment tool based on the International Classification of Functioning, Disability and Health (ICF) developed to evaluate functioning in different patient populations in vocational rehabilitation settings. The objective of this study is to establish the content validity of WORQ-SELF in a subgroup of spinal cord injury (SCI) patients in the early post-acute context.

Methods: Contents of WORQ-SELF were compared with semi-guided interviews with SCI patients in Switzerland, the Comprehensive ICF Core set for SCI early post-acute, and outcome instruments used in vocational rehabilitation and SCI. A frequency analysis was performed.

Results: WORQ-SELF represented 46 different ICF categories and of these 37 categories were confirmed by the patient interviews. The Comprehensive ICF Core Set for SCI confirmed 25 categories. Four instruments used in vocational rehabilitation and SCI setting were identified. Contents of those instruments confirmed 14 categories of WORQ-SELF. Overall, 26 categories of the WORQ-SELF were confirmed by at least two of the three sources, 13 categories by one source and seven were not confirmed by any of the source.

Conclusion: The WORQ-SELF proved to have content validity for utility in patients with SCI within the context of vocational rehabilitation. WORQ-SELF can be used to assess the functioning and disability of patients in the return to work process.

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The effect of arm position and bed adjustment on comfort and pressure under the shoulders in people with tetraplegia

Study design: Randomised, within-in participant cross-over study.

Objective: The purpose of this study was to determine the effect on comfort and pressure of lying with the shoulders and bed in different positions for people with tetraplegia.

Setting: Rehabilitation hospital.

Methods: Twenty people with tetraplegia were tested lying in supine with the shoulders and bed in seven different positions. The positions used a combination of three arm and two bed positions. Six of the positions reflected what is commonly recommended in acute spinal cord injury units including a crucifix-type position. The seventh position was selected by participants and reflected their preferred sleeping position. There were five outcomes: general comfort, shoulder comfort, participant choice of preferred position, peak-pressure under the shoulders and areal-pressure under the shoulders. Pressure was measured using a pressure mapping system and comfort using a visual analogue scale (VAS) on a 10 cm line.

Results: The participants reported significantly higher ($p < 0.01$) general comfort and shoulder comfort in their self-selected position compared to all other positions. There was no statistical difference in peak-pressure ($p = 0.15$) or areal-pressure ($p = 0.08$) under the shoulders between the seven positions. Most participants indicated that they preferred to lie with their shoulders adducted and internally rotated and the hands either by their sides or on their stomachs.

Conclusion: The position of the shoulders has little effect on pressure but a notable effect on comfort. Participants preferred to sleep and lie with their arms beside their bodies, not with their arms in a crucifix position as commonly advocated.

Association between peripheral muscle strength and daily physical activity in patients with Chronic Obstructive Pulmonary Disease

Background: Resistance training of peripheral muscles has been recommended during pulmonary rehabilitation in order to increase muscle strength in patients with chronic obstructive pulmonary disease (COPD). However, whether peripheral muscle strength is associated with exercise performance (EP) and daily physical activity (PA) in these patients needs to be investigated. Objective: To evaluate whether strength of the quadriceps muscle (QS) is associated with EP and daily PA in patients with COPD.

Methods: We studied patients with COPD (GOLD A-D) and measured maximal isometric strength of the left quadriceps muscle (QS). PA was measured for 7 days with a SenseWear Pro® accelerometer. EP was quantified by the 6-minute walk distance (6MWD), the number of stands in the Sit-to-Stand Test (STST), and the handgrip strength. Univariate and multivariate analyses were used to examine possible associations between QS, PA and EP.

Results: In 27 patients with COPD (13 females) with a mean (SD) age 62.3 (5.7) years, FEV1 37.6 (17.6) %predicted, there was a significant positive correlation between QS and the 6MWD, STST, handgrip strength but not with any measure reflecting PA. Multiple linear regression analyses showed that QS was independently associated with the 6MWD ($\beta= 0.42$, 95% CI 0.09 to 0.84, $p= 0.019$), STST ($\beta= 0.50$, 95% CI 0.11 to 0.86, $p= 0.014$) and with handgrip strength ($\beta= 0.45$, 95% CI 0.05 to 0.84, $p= 0.038$).

Conclusions: Peripheral muscle strength is associated with exercise performance but not with daily physical activity.

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Effects of Passive Hydrotherapy WATSU® (WaterShiatsu) in the Third Trimester of Pregnancy: Results of a Cohort Control Pilot Trial

Background: WATSU® (WaterShiatsu) is a bodywork technique comprising buoyancy, passive stretches, massage, and acupressure that is administered in 35° C warm water. This paper reports on a pilot study conducted to evaluate the effects of WATSU® on pregnancy-related complaints in third trimester pregnant women.

Methods: Healthy pregnant women with low-back pain and / or breech presentation at gestational week ≥ 36 were included in the intervention group ($n = 10$). On their first and fourth day of study they received a standardized WATSU®-treatment, underwent ultrasound investigations (fetal position, amount of amniotic fluid, umbilical artery Doppler flow) and completed psychometric questionnaires measuring perceived stress and pain immediately before and after intervention. On day 1 and day 8, they also filled in questionnaires concerning intermediate health related quality of life and stress. Participants in the control group ($n = 7$) completed questionnaires only.

Results: In the intervention group WATSU®-treatment was found to immediately significantly lower participants' levels of perceived stress and pain (VAS) while improving their mood (MDMQ), and to also significantly reduce perceived stress (PSS) in the medium term while improving their mental health related quality of life (SF-36) ($p's \leq 0.028$). In comparison to the control group, participants in the intervention group reported a significant reduction on the perceived stress scale (PSS) from day 1 to day 8 ($p=0.020$). Amniotic fluid showed a tendency to equalize over the course of the week in the intervention group; no negative side-effects were detected during ultrasound measures or reported by participants. As qualitative data indicate, WATSU® was appreciated as an enjoyable and deeply relaxing treatment.

Conclusion: Our findings support the notion that WATSU® yields therapeutic benefits for pregnant women. Further research is warranted.

Development and Validation of the Protective Reaction Assessment for People over Seventy

Background: Each year 30-60% of community-dwelling older adults suffer a fall. One key factor to prevent a fall is the ability of protective stepping. In the present study we developed and analysed a new assessment to test and reassess protective reactions in clinical practice in 30 subjects over 70 year-olds (mean age (SD): 83 (6.6)).

Purpose: The aim of the study was to assess the construct- and convergent validity of the Protective Reaction Assessment (PRA).

Methods: For face validity the assessment was developed in consensus with ten physiotherapy experts. Thirty subjects (age >70) were videotaped while performing the assessment. Recordings were rated by seven independent physiotherapy experts. Rasch analysis was performed to test construct validity. Convergent validity was calculated as correlation of the total score from Berg Balance Scale, a common tool to assess balance ability among the elderly, and the PRA.

Results & Analysis: Rasch analysis reduced the PRA to ten from originally 12 items. The PRA, consisting of ten valid items had a high convergent validity (Spearman's rho = 0.812, p < 0.01, n=30).

Conclusion: The PRA provides a valid instrument to assess protective reactions in the elderly and can be recommended for clinical practice. Further research is needed to prove the reliability of the assessment.

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The measurement of muscle activity and trunk sway in healthy adults during walking with and without a rollator

Objective: This study investigated (1) the effect of rollator walking on lower extremity muscle activity in healthy adults measured by electromyography (EMG) and (2) the influence of rollator walking on trunk stability measured by Sway Star.

Design: Cross-sectional study

Subjects: Nineteen healthy subjects.

Methods: Data was collected over nine gait cycles as subjects walked: without a rollator and in randomized order (1) with a rollator and (2) with rollator with increased weight-bearing on the handles with a “moderate but comfortable amount of pressure”.

Main measures: Mean of the peak EMG for six muscle groups and peak-to-peak angular excursions of trunk sway in the roll (side to side) and pitch (forwards-backwards) directions.

Results: Rollator use significantly reduced EMG activity from baseline ($P < 0.05$) in gluteus medius by 12.82%, in rectus femoris by 14.56%, in semitendinosus by 8.71% and in tibialis anterior by 12.48%. EMG activity was more significantly reduced when using rollator with a push: in gluteus maximus by 29.02%, in gluteus medius by 27.42%, in rectus femoris by 21.80%, in semitendinosus by 20.80%, in tibialis anterior by 12.42% and in gastrocnemius by 10.71%. No significant difference was identified for roll ($P = 0.196$) or for pitch angular displacement ($P = 0.080$) between all three conditions. Conclusion: Both rollator conditions reduced muscle activity in the lower extremities. In this study no statistically significant difference was identified for trunk sway between conditions. Further research must investigate immediate and long-term effects in actual rollator users.

A standardized motor imagery introduction program (MIIP) for patients with sensorimotor impairments: development and evaluation

Background: For patients with sensorimotor impairments, a solid motor imagery (MI) introduction is crucial to understand and use MI to improve motor performance. The study's aim was to develop and evaluate a standardized MI group introduction program (MIIP) for patients after stroke, multiple sclerosis (MS), Parkinson's disease (PD), and traumatic brain injury (TBI).

Methods: Phase 1: Based on literature, a MIIP was developed, comprising MI theory (definition, type, mode, perspective, planning) and MI practice (performance, control). Phase 2: Development of a 27-item self-administered MIIP evaluation questionnaire (MIIP-EQ) to assess MI knowledge (12 items), the self-perception of the skill to perform MI (5 items) and patient satisfaction with the MIIP (9 items). Phase 3: Pre-evaluation of the MIIP and MIIP-EQ with 2 study patients using semi-structured interviews. Phase 4: Case series with a pre-post design to evaluate the MIIP (3x30 minutes) using the MIIP-EQ, Imaprax, Kinesthetic and Visual Imagery Questionnaire (KVIQvis+kin) and Mental Chronometry (MC). Wilcoxon signed rank tests were used to determine significant changes.

Results: Eleven patients (5 females; age 62.3 ± 14.1 years; Mini-Mental State Examination score 28.4 ± 1.5) with stroke ($n=5$), MS ($n=4$), PD ($n=1$) and TBI ($n=1$) were included. After the MIIP, MI knowledge improved significantly (total knowledge score after MIIP 8.8 ± 2.9 compared to 5.4 ± 2.2 before MIIP, $p=0.01$). The self-perception of the skill to perform MI did not change significantly (16.2 ± 4.3 vs. 18.5 ± 2.4 , $p=0.47$). Patients demonstrated high satisfaction with MIIP (37.5 ± 5.2 , maximum possible score: 45). MI ability remained on a high level: Imaprax 33.3 ± 3.3 and 33.6 ± 3.5 ($p=0.733$), KVIQvis 36.2 ± 10.5 and 37.0 ± 6.2 ($p=0.15$), KVIQkin 33.6 ± 9.7 and 29.7 ± 8.2 ($p=0.045$) before and after MIIP, respectively. MC showed no change ($p=0.86$), mean pretest ratio was 1.1 ± 0.4 (range 0.5 - 1.9), mean posttest ratio was 1.1 ± 0.5 , (range 0.5 - 2).

Conclusions: The presented MIIP seems to be valid and feasible for patients with sensorimotor impairments, resulting in improved MI knowledge. MIIP sessions can be held in groups of four or less. MI ability and MC remained unchanged after 3 training sessions.

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