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Abstracts 2014

Masterarbeiten Master of Science in Physiotherapie (MScPT) Studiengang 2011

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Editorial

Sehr geehrte Leserin, sehr geehrter Leser

Sie halten den zweiten Abstractband der Masterarbeiten des Studiengangs Master of Science in Physiotherapie (MScPT) in den Händen. Wir freuen uns sehr Ihnen die Zusammenfassungen der neusten Masterarbeiten präsentieren zu dürfen.

Viele der spannenden Arbeiten haben einen direkten klinisch-praktischen Nutzen oder liefern Grundlagen für weitere Forschungsprojekte. Relevante Fragestellungen wurden identifiziert und mittels einer breiten Palette an Methoden bearbeitet. Die Ergebnisse werden nun in Form von Kongresspräsentationen sowie Publikationen in englisch- oder deutschsprachigen Fachzeitschriften veröffentlicht und an die klinisch-tätigen Kolleginnen und Kollegen in der Praxis weitergegeben.

Diese Leistungen wären ohne die Betreuerinnen und Betreuer der Masterarbeiten sowie ohne die Dozierenden nicht möglich. Sie haben die Studierenden während des Studiums begleitet, ihnen spannendes und relevantes Wissen vermittelt sowie kritisches Denken und Leidenschaft für die Forschung vermittelt. Ihnen allen gilt ein besonderer Dank.

Die Studierenden sind nun Physiotherapeutinnen und Physiotherapeuten MSc, welche die klinisch-wissenschaftliche Entwicklung der Physiotherapie in der Schweiz weiter vorantreiben.

Wir wünschen Ihnen eine spannende und inspirierende Lektüre.

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«Benefits and barriers of a multidisciplinary fall-prevention program. A mixed method study»

Background: Falls in the elderly are a serious public health problem associated with high socio- economic costs. There are effective fall-prevention programs that are also cost effective, however, their feasibility for clinical practice remains to be evaluated in a specific health care system. The aim of this study was to evaluate a multidisciplinary home-based fall-prevention pilot program to further improve this program and to facilitate its implementation.

Methods: The study was designed as a mixed method study including an 'exploratory sequential design'. In the qualitative phase, semi-structured interviews were performed to obtain an in-depth view of the perceptions and experiences among four randomly selected member from each of the four participant groups: general practitioners (GPs), home care nurses (HCNs), all physiotherapists (PTs) and seniors. A deductive content analysis of the interview- data was performed and group- specific written surveys were developed. In the quantitative phase, these surveys were sent to all (potentially) participating GPs (n=262) and HCNs (n= approximately 826), as well as all seniors who participated in the project and consented to this evaluation study (n=32).

Results: The strengths perceived by all groups were the usefulness of the project in detecting risks of falling at senior's home. High overall- satisfaction with the organization of the project was confirmed by 88.24 % of seniors, 94.1 % of GPs and all HCNs and PTs. The most important barrier perceived by the PTs was a lack of GPs and HCNs recruiting seniors with a low risk of falling, to prevent first falls. GPs and HCNs considered the lack of perceived need for fall- prevention by the seniors as an important barrier for inclusion. A further barrier was that 62.5% of seniors confirmed not to carry out further measures such as group- therapies.

Conclusions: Multidisciplinary home based fall-prevention is a useful approach to detect the risk of falling in seniors. Barriers that impede the implementation of the project and decrease its benefit are the lack of appropriately recruiting HCNs and GPs to prevent first falls, the missing perceived need concerning fall-prevention by seniors, and a lack of seniors carrying out further measures.

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Online Physical Therapy Exercises for People with Spinal Cord Injury First Concepts Based on a Grounded Theory Study

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Background: People with spinal cord injury (SCI) have a great need for health information including physical exercise. The Internet is often used as primary source to gain the mentioned information. Unfortunately, the current websites showing physical exercises for people with SCI are of poor quality and lack videos on correct performance of the exercises. To date, no criteria exist for the presentation of online exercises, although this need is clearly stated in the literature.

Objectives: The objective of this study is to identify challenges of online physical therapy exercises in the field of SCI that, from the point of view of experts, hinder or enhance their value and utility.

Design: Qualitative study.

Methods: Ten physical therapy experts in the field of SCI from the German-speaking part of Switzerland participated in semi-structured face-to-face interviews. Interviews were transcribed verbatim and analyzed using grounded theory methods.

Results: Empowering people with SCI emerged as core-category. Sub-categories were: (a) challenges of providing online physical therapy exercises for people with SCI, (b) the influence persons with SCI have on their own empowerment, (c) the ambivalence of the physical therapist and (d) environmental factors.

Conclusions: Physical therapists in Switzerland are not only insecure about the usage and utility of online physical therapy exercises for people with SCI, but also about how to empower people with SCI. To change this situation, there is a need to develop the expressed challenges of online physical therapy exercises further and to educate physical therapists in the usage of this new treatment option. Only the better understanding and enhanced knowledge can reduce barriers and facilitate the implementation of this new tool.

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Nordic Walking with Psychosomatic Inpatients
Adherence, self-efficacy and readiness to change as predictors

Background: Psychosomatic disorders have increased in the last years and form a growing burden for health systems. Increasing the activity level through exercise is one of the goals, when treating persons with psychosomatic disorders in a multidisciplinary clinical setting. If the treatment is supposed to cause effects of long duration, long-term exercise adherence of the patients is needed. The aim of this study is to investigate, whether Nordic Walking is an appropriate type of exercise for psychosomatic inpatients in order to increase the activity level and to adhere to it after discharge. Furthermore self-efficacy and readiness to change are investigated to be predictors for long-term adherence.

Methods: In a randomized controlled trial with psychosomatic inpatients between 18 and 65 years, the effects of an additional Nordic Walking program were compared to usual care. Both groups participated in a multidisciplinary pain program, where as the intervention group additionally followed a supervised Nordic Walking training three times a week for at least three weeks. Activity level was assessed at baseline and three months after discharge. Self-efficacy and readiness to change were assessed at baseline. Statistical analyses were performed on SPSS with non-parametric tests (Mann-Whitney-U-test, Wilcoxon signed-rank test, Spearman's correlation, multiple logistic regression).

Results: After including 138 patients in the study, the complete data sets of 111 patients were used for the analyses. At baseline, the intervention group (n=54) and the control group (n=57) did not differ significantly in age, sex, type of disorders and activity level. Three months after discharge, activity level showed no significant difference whether between the groups nor within the groups from baseline to three months after discharge. Self-efficacy and readiness to change were not confirmed as predictors for long-term adherence.

Conclusion: Nordic Walking is suitable for psychosomatic patients, but does not lead to an improved long-term adherence. The predictors self-efficacy and readiness to change should be measured at other points of time. Consecutive treatment after discharge is recommended.

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The course of pain and passive range of motion of the shoulder joint in patients after rotator cuff surgery
A retrospective cohort study

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Introduction: Rotator cuff tears have a high overall prevalence. Knowing the course of pain and passive range of motion (ROM) after rotator cuff surgeries can help physiotherapists and medical practitioners to make prognoses and to guide patient management. The goal of this study was to investigate the course of pain and passive ROM in patients after rotator cuff surgery, as well as factors, which influence the course of ROM.

Methods: Information about day and night pain and ROM of five shoulder motions was retrieved retrospectively from existing protocols of 149 patients who underwent surgery of the rotator cuff at the Bern University Hospital (Inselspital), Bern, Switzerland. Measurements were conducted on up to seven occasions between discharge from hospital, and six months after surgery. Graphs showing the mean and standard deviation for day and night pain and ROM at each measurement point were generated. Mixed effects models were used to investigate the influence of the predictor variables age, gender, mechanism of injury, surgery number, surgery technique, tendons, and tears on the courses of ROM.

Results: Pain decreased and ROM improved with time. Mean ROM measured after six months was about 10° lower than the corresponding averages for the healthy side. Subjects with single repairs of the subscapularis tendon presented a significantly higher average improvement rate of glenohumeral and global external rotation than the baseline group. Subjects with a repair of both the supraspinatus and infraspinatus tendons displayed a significantly lower average improvement rate of global external rotation. Repairs of both the supraspinatus and subscapularis tendon were related to higher average improvement rates of glenohumeral abduction. First surgeries led to significantly lower average starting points of glenohumeral abduction and global elevation. Subjects with non-traumatic tears presented significantly lower starting points of glenohumeral internal rotation.

Conclusion: Various factors could be determined which influence the course of passive ROM, but differences between subjects suggest the existence of further explanatory variables. Further prospective studies which obtain more balanced data, have a longer follow up and investigate further possible predictors of the course of ROM are needed to get a better understanding of the variation between subjects.

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Reliability of Pelvic Floor Muscle Activity Measurements A Single-Case Study

Introduction and Hypothesis: There remains a lack of knowledge concerning pelvic floor muscle (PFM) activity during functional whole body movements and therapeutic exercises. The purpose of this study was to test the reliability of different PFM activity measurements with the Periform®+, the Pelvaflex®+, the double-pole Stimpon®, and the three-pole Stimpon® probe. We hypothesized that the measurements will be feasible and reliable for all measured variables concerning PFM activity.
Methods: This single-case study investigates the feasibility and intra-session retest reliability of multiple PFM surface electromyography (sEMG) measurements.
Results: The measurements with the Pelvaflex®+ were not feasible. Six measurements could not be analysed because of too low sEMG amplitudes. The reliability regarding the activity variables and one time variable of 31 measurements could be analysed.
Conclusions: As both Stimpon® probes provided more precise results than the Periform®+, larger studies should test the reliability of both Stimpon® probes of different PFM activity measurements.

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Prevalence and functional consequences of femoroacetabular impingement in male junior ice hockey players. An exploratory cross-sectional study.

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Background: The prevalence of femoroacetabular impingement (FAI) is relatively high in male ice hockey players. It is yet unknown if FAI-related bony deformities may lead to functional consequences such as reduced hip muscle strength, range of motion (ROM) and on-ice physical performance.

Hypothesis: Compared to players with no signs and no symptoms of FAI, symptomatic FAI players would show hip muscle weakness and reduced hip ROM especially for internal rotation, which would in turn influence ice-hockey specific physical performance.

Study design: Cross-sectional study.

Methods: Seventy-four male junior ice hockey players were tested for hip internal rotation ROM using an examination chair. The hip with less internal rotation ROM was tested with magnetic resonance image (MRI) to diagnose possible FAI. A blinded investigator for the MRI outcome applied the flexion-adduction-internal rotation (FADIR) provocation test on the same hip as the MRI to classify the hip as symptomatic or not. Muscle strength was tested unilaterally for each hip muscle group using dynamometry, ROM was assessed unilaterally for all hip directions using a simple long-arm goniometer and on-ice acceleration, speed and agility were evaluated using photocells.

Results: Twenty-four players had no FAI. Fifty players had a diagnosis of FAI, of whom 24 were symptomatic. No significant differences in hip muscle strength, hip ROM and on-ice physical performance were found between players with no FAI, symptomatic and asymptomatic FAI players.

Conclusions: Despite a high prevalence of FAI in junior male ice hockey players, symptomatic and asymptomatic FAI did not induce functional impairments in terms of hip muscle strength, hip ROM and physical performance on the ice.

Clinical relevance: It is important to diagnose FAI as early as possible in junior ice hockey players before cartilage lesions of the femoral head occur and to treat symptoms conservatively with physiotherapy without taking care of functional consequences.

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Modulation of gait kinematics by a novel body weight support system for overground walking

Regaining walking capacity and the corresponding mobility and independence in daily life is one of the fundamental tasks in movement rehabilitation. Treadmill training, with or without body weight support (BWS) has to be shown to be an efficient training intervention to regain this walking capacity. However, overground training is preferred because it is closer to reality, since the center of body mass is moved forward on one's own initiative. The Free Levitation for Overground Active Training (FLOAT) is a novel robotic system which enables dynamic BWS while walking overground with unprecedented degrees of freedom. Rehabilitation is successful when gait parameters are physiological as possible and are close to reality. Therefore, in this study the effects of BWS on distance parameters (stride length and step width) and kinematics of the hip, knee and ankle joints were characterized in ten healthy subjects aged between 20 to 40 years, using a 3-D motion capture system (Vicon). The subjects walked overground at 1 km/h and 2 km/h with six different BWS (0% baseline, 10%, 20%, 30%, 40%, 50%) applied through the FLOAT. The median distance parameters and kinematic range of motion (ROM) from the gait cycles of six times five meters of walked distance were statistically analyzed. The Friedman test ($p < 0.05$) was used to analyze the influence of BWS, and Wilcoxon signed-rank test for post-hoc analysis (Bonferroni corrected). Increasing BWS resulted in significant effects at 1 km/h in the ROM of the hip (30%, 40%, 50% BWS compared to baseline), the knee (20%, 30%, 40%, 50% BWS compared to baseline), and the ankle (40%, 50% BWS compared to baseline). At 2 km/h, significant effects were observed in the ROM of the hip (50% BWS compared to baseline) and stride length (30% BWS compared to baseline). Significant effects of BWS on the distance and kinematic parameters of healthy subjects were observed, but these effects appeared only at high BWS and low walking speed. Clinically, the observed effects are small but not negligible. Therefore, it can be concluded that the FLOAT is a valuable training robot for overground walking and balance training at low BWS. Application of BWS through the FLOAT does not induce a pathological gait pattern.

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Validation of a smartphone-based measurement tool for the quantification of level walking

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Introduction: It is important to assess and quantify gait in order to determine the severity of impairments during gait and to evaluate therapeutic interventions. However, laboratory gait assessment is expensive and time consuming and there is a lack of an easily applicable tool for the quantification of gait in clinical practice. The aim of this study was to validate a smartphone-based measurement tool for the quantification of level walking.

Methods: Vertical centre of mass displacement and step duration of 22 healthy young adults were assessed by a smartphone application and a Vicon motion capture system. Intra-session reliability was evaluated by repeated-measures ANOVA, intraclass correlation coefficient (ICC), and standard error of measurement. In order to evaluate the concurrent validity of the smartphone application, smartphone- and Vicon-derived values were compared by Pearson correlation coefficient and Bland-Altman limits of agreement.

Results: Six out of eight variables derived by the smartphone application showed an excellent reliability (ICC ≥0.75) and all variables correlated significantly with measurements of the Vicon motion capture system with moderate to strong correlations ranging from 0.61 to 0.92.

Conclusion: The results showed a great potential of the smartphone application to be a user-friendly and valid tool for the assessment of gait in clinical practice. Further research needs to investigate whether the smartphone application is able to detect differences in gait patterns following therapeutic or orthopaedic interventions and whether it is valid for the quantification of gait in people with movement disorders.

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Does hip abductor fatigue influence single-leg landings and side-step cutting maneuvers?

Background: An increased knee valgus angle is a potential knee injury mechanism during sports. However, the influences of hip abductor fatigue on frontal plane knee angles are not yet well understood.

Hypothesis: We hypothesized that hip abductor fatigue increases the knee valgus angles at landing after a single-leg jump and side-step cutting maneuver. We further hypothesized an ipsilateral trunk lean and altered electromyographic (EMG) activity. We additionally expected correlations between the trunk and knee angles as well as between the EMG activities and knee angles.

Methods: Twenty participants (9 women, 11 men, mean age 30.3 (SD 4.0) years) performed a single-leg jump and side-step cutting maneuver before and after a hip abductor fatigue protocol. Kinematic data of the knee and trunk as well as EMG activity of the m. gluteus medius (GM), m. tensor fasciae latae (TF), m. vastus medialis (VM) and m. erector spinae (ES) were recorded.

Results: Hip abductor fatigue increased the knee angle of the single-leg jump into a more accentuated varus position ($p < 0.05$) and significantly delayed the muscle activity onset of the GM, ES and VM. Furthermore, VM peak as well as VM and TF mean EMG increased. For the side-step cutting the occurrence time of the maximum trunk lean angle and the GM peak was delayed after fatigue. The ES peak increased after fatigue (all $p < 0.05$).

Conclusion: Contrary to our hypothesis, our results showed an increased knee varus angle and no significant ipsilateral trunk lean after hip abductor fatigue.

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Die Responsivität der deutschsprachigen Version des Neck Disability Index (NDI-G)

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Hintergrund: Nackenschmerzen treten häufig auf und führen vielfach zu grossen Einschränkungen. In der Forschung und im Klinikalltag spielen standardisierte Messinstrumente um bei Patienten Nackenschmerzen einschätzen zu können, eine zentrale Rolle. Der Neck Disability Index (NDI) ist der meist verwendete Fragebogen bei Patienten mit Nackenschmerzen.

Ziel: Das Ziel dieser Arbeit war, die Überprüfung der internen und externen Responsivität, der deutschsprachigen Version des NDI (NDI-G). Methode: Der NDI-G, die Schmerzskala Visual Analoge Scale (VAS) und der Lebensqualitäts-Fragebogen (EQ5D5L, EQ5D5L-VAS) wurden durch 30 Patienten mit Nackenschmerzen (Grad 1 oder 2) zum Startzeitpunkt der Studie, zweimal nach 4-8 Tagen und einmal nach 6 Wochen ausgefüllt. Die interne Responsivität wurde über die Berechnung der Effektgrössen und die Standardabweichung der Mittelwerte, jeweils vom Startzeitpunkt aus, ermittelt. Die externe Responsivität berechneten wir anhand der Korrelationskoeffizienten der Veränderungen.

Resultate: Die deutschsprachige Version des NDI zeigte nahezu moderate bis hohe Effektgrössen und Standardabweichungen der Mittelwerte (ES1 ES2= 0.440-1.077). Die Spearman-Korrelation zeigt eine moderate bis gute Beziehung zwischen der Veränderung des NDI-G, der Veränderung des EQ5D5L und der VAS (r= 0.302-0.851). Im Bezug auf die EQ5D5L-VAS konnte aber nur eine geringe Korrelation dargestellt werden (r= 0.117-0.398).

Schlussfolgerung: Die deutschsprachige Version des NDI (NDI-G) weist eine gute interne und externe Responsivität auf. Die Responsivität ist vergleichbar mit anderen Versionen. Der NDI-G erweist sich als nützliches Messinstrument in der Forschung und im Klinikalltag.

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Reliabilität von leistungsbestimmenden Faktoren im Riemenrudern

Das Umlernen von komplexen motorischen Bewegungen mithilfe eines Simulators stellt eine aktuelle Forschungslücke dar. Als Beispiel für eine komplexe motorische Bewegung wurde das Riemenrudern gewählt. Gegenstand dieser Arbeit ist es, die Akzeptanz des Rudersimulators bei Riemenruderer sowie die Reliabilität von leistungsbestimmenden Faktoren zu untersuchen, um damit eine Interventionsstudie durchführen zu können. Leistungsbestimmende Faktoren im Riemenrudern sind die Schlaglänge, der Kraftstoss an der Ruderdolle, der Kraftstoss am Stemmbrett sowie die mittlere Bootsgeschwindigkeit. Es gilt, die zufällige Variabilität und das 95% Limit of Agreement dieser leistungsbestimmenden Faktoren auf der gewohnten und ungewohnten Ruderseite zu bestimmen. In einem Test-Retestverfahren wurden 10 Probanden innerhalb einer Woche beim Riemenrudern auf der gewohnten und ungewohnten Ruderseite im Zweier ohne Steuermann untersucht. Es wurde eine Ruderstrecke von 1000m in möglichst geringer Zeit absolviert. Zudem bewerteten die Probanden die Akzeptanz des Rudersimulators mittels eines Präsenz-Fragebogens. Die zufällige Variabilität variierte bei der Schlagzahl zwischen 1.8-2°, beim Kraftstoss an der Ruderdolle zwischen 28.5-36 Ns, bei der Stosskraft am Stemmbrett zwischen 28.2-39.5 Ns. Die zufällige Variabilität der Bootsgeschwindigkeit betrug 0.1 m/s. Das 95% Limit of Agreement der gewohnten und ungewohnten Seite betrug bei der Schlaglänge -1.2±3° bzw. -1±2.1°, beim Kraftstoss an der Ruderdolle -2.7±38.5 Ns bzw. 1.9±11.9 Ns, bei der mittleren Bootsgeschwindigkeit -1±7% bzw. 1±8% sowie beim Kraftstoss am Messstemmbrett 22.9±65.2 Ns bzw. -25.4±63.9 Ns. Die Akzeptanz des Rudersimulators fiel hoch aus (mittlerer Punktwert 5.5/ 7). Bei zukünftigen Studien empfiehlt sich die Berücksichtigung der zufälligen Variabilität, des kleinsten messbaren Unterschiedes sowie des 95% Limit of Agreement zur Interpretation leistungsbestimmender Faktoren im Riemenrudern. Die Einschätzungen der Ruderleistung im Rudersimulator, anstelle des instrumentierten Messboots sollte in Zukunft überprüft werden.

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Sensor-based intersession reliability study of active lumbar spine movements among low back pain and healthy subjects

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Background: In clinical practise it is still exceedingly difficult to assess active spine movements. The common clinical appraisal of active back movement in physical therapy is visual observation. It is therefore not possible to reliably quantify back movements for diagnostic outcome or for therapy progress. The aim of this study is to identify retest reliability in active lumbar spine movements measured with inertial sensors.

Methods: Micro-electro-mechanical systems sensors were used to measure movement variables of the lumbar spine. To investigate retest reliability, 20 nonspecific low back pain (NSLBP) patients and 20 healthy participants wore sensors on the spine and performed a standardized set of eleven active movement tests twice within eight days. The study was performed in a rehabilitation centre in Schinznach-Bad, Switzerland and the University of Applied Sciences in Zürich. A two-facet fully crossed design from generalizability theory (G study) was used to describe absolute and relative reliability among tests and groups.

Results: The relative G coefficient values ranged between 0.03 and 0.92 for the NSLBP- and between 0.39 and 0.92 for the healthy group. Test-retest reliability of lumbar spine movement tasks for range of motion tests among NSLBP patients was excellent (0.84-0.92 absolute G coefficient). All six movement control tests showed moderate retest reliability and the reposition error task showed poor retest reliability. Minimal detectable change for angular deviation between the sensors placed on the sacral segment S2 and the lumbar segment L1 varied from 2.2 to 14.64 angle degrees for lumbar spine movement tests. Relatively large MDC values in relation to the means on movement control tests indicate that these tests should be used with caution.

Conclusion: Micro-electro-mechanical systems sensors are practical and affordable tools for measuring movement of the lumbar spine. The results regarding test-retest reliability between groups suggest that higher reliability coefficients for participants with chronic NSLBP are more difficult to achieve. The difference in reliability among certain movement tasks refers to the consistency of these tests. This initial evaluation of different lumbar movement tests provides some of the know-how that is necessary to develop accurate research on this topic.

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Development of a short version of the Spinal Function Sort

Purpose: To develop a revised version of the SFS, a picture-based questionnaire, which measures perceived functional ability of the spine for patients with chronic low back pain (CLBP).

Methods: A mixed method design consisting of 4 parts was performed. In interviews participants were asked which postures and activities of the 50 SFS items were related to their back pain (part 1). Quantitative analysis of items consisted of measuring floor and ceiling effect, internal consistency with all and half of the items, item to total correlations, principal component (PCA)- and Rasch-analysis (part 2). A review of the literature was performed for relevant risk factors for low back pain (part 3). Experts rated the SFS items based on relevance (part 4). Based on the results of parts 2-4 a total score for each item of the SFS was calculated, and merged with the results of the interviews.

Results: From interviews with 17 participants, eight new items emerged (part 1). Quantitative analysis (part 2) demonstrated a floor effect of four items of very heavy material handling. Cronbach's alpha was 0.98 for all, and 0.96 for half of the items, indicating item redundancy. Item to total correlations values were >0.6. Good item response was confirmed by Rasch analysis. Unidimensionality of the SFS was supported by results of PCA. Results of literature review (part 3) were not congruent with factors reported in the interviews. Experts rated all items as relevant (part 4). From the original SFS 24 items confirmed an adequate total score.

Conclusions: A revised version of the SFS with 32 items has been developed. The reliability and validity of this shorter version should be tested.

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Validation of the Comprehensive ICF Core Set for Vocational Rehabilitation from the Perspective of Physical Therapists: An International Delphi Survey

Background: The Comprehensive ICF Core Set for Vocational Rehabilitation (VR) contains a list of categories from the International Classification of Functioning, Disability and Health (ICF), which describe a standard for interdisciplinary assessment, documentation and communication in the process of return-to-work.

Objective: To establish content validity of the Comprehensive ICF Core Set for VR from the physical therapist's (PT) perspective.

Design: A 3-round e-mail survey has been performed using the Delphi method.

Methods: PTs currently working in VR with work experience of ≥ 2 years were asked to list aspects they consider as relevant when evaluating and/or treating clients in VR. Answers were linked to the respective ICF categories and compared with the Comprehensive ICF Core Set for VR.

Results: Sixty-two PTs from all 6 WHO regions collected 3,917 statements that have been linked to 338 ICF categories. Fifteen of the 90 categories in the Comprehensive ICF Core Set for VR have been confirmed from PTs. Twenty-two ICF categories have been identified as additional ICF categories that were not represented in the Comprehensive ICF Core Set for VR.

Limitations: VR in physical therapy is internationally still seen as an emerging topic and leads to a limited number of participants.

Conclusion: With this survey, the core competences for PTs in VR could be clarified. Its comparison with the ICF Core Set for VR allows a clear allocation of the competences within the multidisciplinary team, leads to a better use of synergies and further to a reduction of redundancies.

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Test-retest reliability of thermal quantitative sensory testing on two sites within the L5 dermatome of the lumbar spine and lower extremity

Introduction: Quantitative Sensory Testing (QST) is widely used in human research to investigate the integrity of the sensory function in patients with pain of neuropathic origin, or other causes such as low back pain. Reliability of QST has been evaluated on both sides of the face, hands and feet as well as on the trunk (Th3-L3). In order to apply these tests on other body-parts such as the lower lumbar spine, it is important first to establish reliability on healthy individuals. The aim of this study was to investigate intra-rater reliability of thermal QST in healthy adults, on two sites within the L5 dermatome of the lumbar spine and lower extremity.

Methods: Test-retest reliability of thermal QST was determined at the L5-level of the lumbar spine and in the same dermatome on the lower extremity in 30 healthy persons under 40 years of age. Results were analysed using descriptive statistics and intraclass correlation coefficient (ICC). Values were compared to normative data, using Z-transformation.

Results: Mean intraindividual differences were small for cold and warm detection thresholds but larger for pain thresholds. ICC values showed excellent reliability for warm detection and heat pain threshold, good-to-excellent reliability for cold pain threshold and fair-to-excellent reliability for cold detection threshold. ICC had large ranges of confidence interval (95%).

Conclusion: In healthy adults, thermal QST on the lumbar spine and lower extremity demonstrated fair-to-excellent test-retest reliability.

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Cut-off values for the assessment of sensor-based lumbar Movement Control Impairment Tests

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Background: Low back pain (LBP) is a common problem in our society. Defining subgroups in the wide field of LBP patients is necessary for effective treatment. Thus, the Movement Control Impairment Test Battery (MCITB) detects patients with a movement control dysfunction. A measurement system is meant to help physiotherapists detecting these patients. The threshold of positive or negative results in four tests of the MCITB is defined with the assistance of trained physiotherapists.
Methods: This diagnostic study used trained physiotherapists to define a cut- off area in four Movement Control Impairment Tests using a sensor-based measurement system. The four tests were: Pelvic tilt (PT), Waiters bow (WB), Sitting knee extension (SKE) and Rocking backwards (RB). The range of motion (ROM) of vertebrae S2 to L1 was measured with non-invasive sensors. 56 videos of participants were analysed by six trained physiotherapists. The Inter- and Intra-observer reliability and the parallel validity were calculated to maximize the accuracy of the cut-off area.
Results: Kendall's W for Inter- and Intra-observer reliability ranged on a substantial to almost perfect level between 0.66 – 0.93 and 0.84 – 0.99. PT (-0.84), WB (0.68) and SKE (0.72) showed a substantial to almost perfect correlation between the ratings and the measurement system. RB was excluded from further analysis because of an insufficient correlation (0.46). The defined cut-off areas for positive and negative tests were 8.9° - 13.9° in PT, 19.8° - 24.9° in WB and 4° - 4.3° in SKE.
Conclusions: The measurement system was proven to be helpful in diagnosing a movement control dysfunction with the reported thresholds.

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Criterion and convergent construct validity of the Trunk Control Measurement Scale

Trunk control is essential for the performance of everyday tasks. Children with neurological impairments such as cerebral palsy and acquired brain injury commonly show impaired trunk control, which leads to restriction in functional activities. The aim of this study was to provide criterion and construct validity of the Trunk Control Measurement Scale (TCMS). We investigated criterion validity using a force plate. The centre of pressure (COP) parameters included the standard deviation of amplitude, the COP displacement and the area. The modified Timed up and Go (mTUG) and the Gross Motor Function Classification System (GMFCS) were administered for convergent construct validity. Sixty-two children with congenital and acquired brain injury (mean age 10.9 years 4.9 months, range 5-18 years, GMFCS level I-IV) were included in this study. For criterion validity, TCMS scores were divided into "able" and "unable" to perform. In the majority of TMCS items, some COP parameters showed a significant difference between these two categories. For construct validity, the Spearman rank correlation coefficient was calculated between the TCMS and GMFCS (ρ=-0.748) and the mTUG (ρ=-0.421). These results support the validity of this German TCMS version in children with brain lesions. This study provides paediatric therapists working in clinical and research settings with a valid tool to assess impaired trunk control in these children in German. Although originally designed for children with spastic cerebral palsy, our results show that the TCMS may also be applicable to other diagnoses, but more research is needed on a larger population.

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Effects of an induced extension restriction in the knee on secondary gait deviations in healthy young adults

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Introduction: Unilateral knee flexion contractures (KFC) are frequently seen in orthopaedic rehabilitation. In order to get a more comprehensive knowledge concerning secondary gait deviations of such contractures, we artificially induced a knee extension restriction (KER) to healthy young adults. In particular, we wanted to identify secondary gait deviations at both hips, knees, and ankles in the sagittal plane during the stance phase of gait.

Methods: Gait of twenty-four subjects was recorded by a motion capture system and two force plates. Two knee conditions (no restriction and 30° extension restriction) were simulated with a knee brace. Sagittal plane kinematic and kinetic data of both hips, knees, and ankles were analysed and compared using a paired t-test.

Results: Analysis revealed significant differences between conditions for most kinematic and kinetic outcome variables. The true KER was less than the restriction angle set at the brace. On the braced side, we found increased peak ankle dorsiflexion, decreased peak hip extension, increased mean extension moments at the knee, decreased peak hip flexion moments and decreased peak ankle plantarflexion moments at the 30° KER. On the contralateral side, differences were generally smaller.

Conclusion: An induced KFC leads to numerous secondary gait deviations and asymmetric joint loading. The results suggest that KFCs should be addressed early in orthopaedic rehabilitation in order to prevent longterm increased joint loading. Future research should focus on differentiation between passive deviations and active compensations by including the measurement of muscle activity and upper body kinematics.

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Spinal Sagittal Posture and Motion Patterns in Young and Elderly Subjects

Musculoskeletal disorders causing pain and physical dysfunction create a major personal and financial burden all over the world. The majority of the population in western countries suffer from age-related musculoskeletal disorders; those affecting the spine may have a large impact on spinal balance and motion in daily living. For this reason, it is of high importance to understand the different aspects of spinal sagittal balance and spinal motion characteristics by healthy humans, especially when aging occurs in order to obtain better knowledge about physiological and pathological spinal alignment and motion. A wide range of thoracic kyphosis and lumbar lordosis angles for healthy subjects has been reported in literature according to the spinal sagittal balance. Only few studies so far have been performed to characterize sagittal segmental motion of thoracic and lumbar spine.

In this study, 43 healthy subjects were recruited (young and elderly) in order to examine their spinal curvature in different standing postures and throughout the flexion motion task.

A wide range of sagittal posture curvatures was observed in both age groups. The thoracic curvature angle in a neutral standing posture was significantly larger in elderly compared to young volunteers (53.4° ± 8.1° and 47.5° ± 9.5°, respectively). In addition, the range of motion in the lumbar spine was remarkably lower in elderly (53.3°± 13.8°), compared to young subjects (72.6°± 11.0°).

Similarly to the posture measurements, there was a large inter-subject variability in the motion patterns characteristics. Not all subjects could have been allocated into different classification groups. However, over 40% of the young subjects performed flexion with the biggest segmental amount of flexion with L5/S1 which was rarely seen in elderly. In contrast, the segmental thoracic motion with the largest amount of flexion performed by in the lowest thoracic segment was observed in all subjects.

Since the understanding of normal physiological spinal posture and in particular spinal motion remains difficult due to the wide inter-personal variability, it is fundamentally important to pursue further research investigating normal physiological sagittal balance and spinal segmental motion patterns and their alteration due to aging, in order to improve in the future a distinction between normal and pathological spinal posture and motion.

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Reliability and Validity of parameters during Stair Ascent measured with Leonardo Mechanograph® Stair A in Healthy Subjects

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Background: Stair climbing (SC) is a daily activity with an adaptable movement pattern. Many different SC tests exist, but none of them directly measures force over more than two steps. The Leonardo Mechanograph Stair A has five steps and four integrated force sensors. The aim of this study was to investigate the reliability and validity of the Leonardo Mechano-graph Stair A test, for the variables of force, power and time to stair ascent.

Methods: 55 healthy participants (mean age 48±14 years) were tested during SC first with self-chosen speed and secondly as fast as possible; validity was evaluated with the correlation to the international physical activity questionnaire (IPAQ). Therefrom 30 people were examined for test-retest-reliability, calculated with the intraclass correlation coefficient (ICC2,1). Validity was further analysed with squat- and countermovement jumps on a force plate. The variability was examined with the coefficient of variation (CV).

Results: The ICCs (2,1) of normal SC were good to excellent and ranged from 0.64-0.77. The CVs showed values of 2.3-13.2%, whereas the CVs for normal SC were lower than those for fast SC. The analysis of rank showed significant results, people with a lower IPAQ score have lower force values in normal SC and older aged people needed more time for SC.

Conclusion: The Leonardo Mechanograph Stair A is a reliable tool and has small asso-ciations with parts of the IPAQ but not with the force of jumps. Further research needs to investigate validity with other measurements as well as studies with patients.

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Therapists' perspective on virtual reality based treatments in patients after stroke: A qualitative study

Purpose: During the last decade, Virtual Reality (VR) has become a new component in the treatment of patients after stroke. To evaluate VR technology and the YouGrabber training system in particular, this study aimed on (i) to provide an overview of therapists` experiences and expectations with the VR training system and (ii) to present therapists` future prospects of VR in stroke rehabilitation.

Methods: Lived experiences of therapists were investigated by conducting three focus groups with three occupational and six physiotherapists specialised in stroke rehabilitation. Data analysis was done by a qualitative content analysis using a phenomenological approach.

Results: Four main themes were extracted: Relationship between therapists, patients, devices, future prospects and developments of VR in neurorehabilitation. Benefits like motor learning principles and patient motivation in VR-based training for a future health care model were discussed.

Conclusions: Findings support interdisciplinary collaboration in development of VR technology and help to shape the environment for VR implementation in clinical practice. VR as a treatment tool complements conventional approaches in occupational and physiotherapy.

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Discriminant validity and test re-test reliability of a gait assessment in patients with vestibular dysfunction

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Background: Gait function may be impaired in patients with vestibular disorders disorders, making gait assessment in the clinical setting relevant for this patient population. The GAITRite® walkway analysis system may be used to assess spatio-temporal gait parameters.

Objective: The purpose of this study was to evaluate the discriminant capability and test re-test reliability of gait performance measures in patients with vestibular lesions under different walking conditions by the use of the GAITRite® system.

Methods: Gait parameters of thirty-nine patients with vestibular disorders and twenty-seven healthy controls were assessed with the GAITRite® system. Discriminant capability (t-test), relative reliability (intra class correlation [ICC]), and absolute reliability (standard error of measurement [SEM], smallest detectable change [SDC]) were determined for gait speed, cadence, and step length. Bland-Altman plots were made to determine systematic bias between tests.

Results: A significant effect of grouping on gait performance hints at discriminant capability of gait assessment. All tests distinguished differences between patients and healthy controls ($p<0.05$), expect for tandem walking. The ICCs for relative reliability were excellent (0.76-0.96), absolute reliability showed acceptable SDC values for gait parameters derived from three walking conditions (9-19%). Bland-Altman plots indicated no systematic bias.

Conclusions: Good reliability of the GAITRite® system measurements and discriminatory capability suggests that the GAITRite® system could facilitate the study of gait in patients with vestibular disorders. The SDC values for gait are generally small enough to detect changes after therapy.

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Ein Vergleich der Gehgeschwindigkeiten von Senioren mit der zur Verfügung stehenden Zeit um bei Fussgängerampeln die Strasse zu überqueren

Fragestellung: Eine Beeinträchtigung der Mobilität ist ein verbreitetes Problem von älteren Menschen. Diese Studie untersucht Gehgeschwindigkeiten von Senioren und vergleicht diese mit der zur Verfügung stehenden Zeit bei Fussgängerampeln um eine Strasse zu überqueren. Das Ziel ist eine Einschätzung der Gehgeschwindigkeit von älteren Personen im Hinblick auf aktuelle Anforderungen in der Stadt St. Gallen in der Schweiz.

Methodik: Es wurde eine Querschnittstudie durchgeführt mit einer anfallenden Stichprobe von 120 Probanden. Die Teilnehmer waren älter als 69 Jahre, lebten selbständig in und um St. Gallen und waren in der Lage 30 Meter zu gehen. 4 unterschiedliche Gehgeschwindigkeiten wurden gemessen: die selbstgewählt-normale und selbstgewählt-erhöhte Gehgeschwindigkeit, sowie die selbstgewählt-normale und selbstgewählt-erhöhte Gehgeschwindigkeit mit kognitiven Zusatzaufgaben. Weitere Daten wurden mündlich erhoben.

Ergebnisse: Die durchschnittliche Gehgeschwindigkeit bewegte sich zwischen 0.97m/s (±0.30) und 1.42m/s (±0.35). Je nach Gehgeschwindigkeit waren 26.7% bis 75.8% der Teilnehmer nicht in der Lage 1.2m/s zu gehen. Laut des Spearman-Koeffizienten korreliert eine verlangsamte Gehgeschwindigkeit signifikant (p-Wert = 0.01), und leicht negativ mit einem erhöhten Alter (r_s = -0.458 bis -0.495), Sturzereignissen in den vergangenen 6 Monaten (r_s = -0.241 bis -0.3), einer schlechteren Gesundheitseinschätzung (r_s = -0.324 bis -0.39) sowie der Verwendung eines Gehhilfsmittels (r_s = -0.44 bis -0.607).

Schlussfolgerung: Die reine Gehgeschwindigkeit ist nur eine von vielen Anforderungen, um eine Strasse sicher überqueren zu können. Sogar unter vereinfachten Bedingungen im Labor waren 26.7% der Probanden nicht in der Lage die erforderliche Gehgeschwindigkeit zu erreichen, welche bei einer Strassenüberquerung während der Grünphase einer Verkehrsampel benötigt wird. Die körperliche Fitness der Probanden scheint nicht ausreichend zu sein für die Anforderungen der Umwelt.

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German Translation and Validation of the «Freezing of Gait Questionnaire» in Patients with Parkinson's Disease

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Objectives: Freezing of Gait (FOG) is a frequently observed and disturbing parkinsonian symptom. The Freezing of Gait Questionnaire (FOG-Q) reliably detects FOG in patients with Parkinson's disease (PD). The aim of this study was to develop a German translated version of the FOG-Q and to assess its validity.

Methods: The translation was accomplished using forward-backward-translation. The construct validity of the FOG-Q was examined in twenty-seven German native speaking PD patients. Convergent validity was assessed by correlating the FOG-Q with the Movement Disorder Society – Unified Parkinson's Disease Rating Scale (MDS-UPDRS) II-III, the Parkinson's Disease Questionnaire 39 (PDQ-39) and the Timed Up and Go Test (TUG). Divergent validity was assessed by correlating the FOG-Q with the MDS-UPDRS I. The internal consistency was measured using Cronbach's alpha ($C\alpha$).

Results: A good internal structure of the FOG-Q was found ($C\alpha = 0.83$). Significant correlations between the FOG-Q and the MDS-UPDRS item 2.13 ($rs = 0.568$, $p = 0.002$) and between the FOG-Q and the PDQ-39 subscale mobility ($rs = 0.516$, $p = 0.006$) were found. The lack of correlation with the MDS-UPDRS I demonstrated good divergent validity.

Conclusion: The German FOG-Q is a valid tool to assess FOG in German native speaking PD patients.

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Dynamic stiffness and energy dissipation of porcine ligaments and tendons: an in-vitro study

This basic research compares the biomechanical properties of ligaments and tendons to each other and sets a new conceptual framework for test settings in research using bio-logical tissues. The present study conducts in-vitro uniaxial tensile loading tests with ligaments and tendons, using an accurate non-contact measurement test setting. The results of the two structures are compared to each other and to previous research. The biomechanical properties, dynamic modulus of elasticity E* (E*-modulus) and loss angle δ of porcine antero-medial anterior cruciate ligament bundle (AM-ACL, n = 14) and patellar tendon (PT, n =13), were evaluated applying a short time slow cyclic tensile load. Using an electromechanical test machine MTS, a Vicon motion capture system, and a rotatable LASER device, measurements were performed with precision in sub millimetre range.

The results showed a significant difference in the elastic behaviour of ligaments and tendons. E*-modulus median value in AM-ACL 10% relative strain was 44.9 MPa, in AM-ACL 15% relative strain 110.5 MPa and in PT 5% relative strain 315.9 MPa. No significant difference was found between energy dissipation of ligaments (loss angle δ of 1.8°) and tendons (loss angle δ of 2.2°). These results confirm the trend of previous research. The extent of the outcome is, however, not consistent with previous research.

This research reveals that porcine ligaments and tendons under slow cyclic tensile load develop different elastic behaviour while dissipating a similar amount of energy. At the same time the study presents an accurate measurement test setting for small amounts of biological tissue. Both findings, transferred into future research, may support and enhance development of surgical and conservative treatment approaches to ligaments and tendons.

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Measurement Properties of the Brief Michigan Hand Outcomes Questionnaire in Patients with Dupuytren's Disease

The objective of this cohort study was to investigate the measurement properties of the brief Michigan Hand Outcomes Questionnaire (briefMHQ) in 40 patients diagnosed with Dupuytren's disease who received intervention. Patients filled out the briefMHQ twice, namely at baseline and 6 weeks after intervention. At baseline and 6 weeks, they also completed the full MHQ. We calculated test-retest reliability (intraclass correlation coefficient, ICC), internal consistency (Cronbach's alpha), Spearman's correlation coefficient (r) with the MHQ for validity, responsiveness (effect size), and minimal important change. For the briefMHQ, we found an ICC of 0.82, Cronbach's alpha of 0.88, and a correlation of r = 0.90 with the full MHQ. The effect size remained small with 0.25 and the MIC was 14 points. In conclusion, the briefMHQ shows good reliability and validity, but is not sensitive enough to detect changes in patients with Dupuytren's disease within 6 weeks.

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How do clinical educators foster clinical reasoning of undergraduate physiotherapy students: an ethnographic approach

Introduction: Clinical reasoning is a key competence in physiotherapy practice. Therefore, the development of clinical reasoning skills in physiotherapy students is essential. During their internships the students are mentored by clinical educators, which play an important role in the development of the student's clinical reasoning skills.

Methods: This study adopted an ethnographic approach with the aim to explore how the clinical educators foster the clinical reasoning skills in undergraduate physiotherapy students. Formal interactions between clinical educators and students were observed in different hospitals. During the observations fieldnotes were taken and the interactions were audiotaped. Additionally, semi-structured interviews with the educators were performed and audiotaped. Data was analysed using a systematic, grounded, and open-ended ethnographic approach.

Findings: Three types of clinical situations were observed: supervisions, debriefings, and case discussions. Within these clinical situations three main themes were identified: exploring thinking, providing support, and further management. For each theme several subthemes were described as tools to facilitate the student's clinical reasoning skills. A model of how the clinical educators tried to foster clinical reasoning is presented.

Discussion and conclusion: The ethnographic approach allows considering important aspects of clinical reasoning such as context-dependability and the collaborative exchange during interactions between clinical educators and students. The clinical educators provide different clinical situations and apply various tools in order to facilitate the student's clinical reasoning. The most often used tools are enquiry, reflection, patient presentations, and feedback. Whether the educators intended to provide a safe and effective patient management and/or intended to foster the student's clinical reasoning skills was seldom made explicit. It is therefore proposed that the clinical educators need to consciously and explicitly engage in the student's learning of clinical reasoning.

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Neuromuscular Control Mechanisms during Single-Leg Jump Landing in Sub-Acute Ankle Sprain Patients: A Case Control Study

Optimal neuromuscular control mechanisms are essential for preparing, maintaining and restoring functional joint stability during jump landing and to prevent ankle injuries. In sub-acute ankle sprain patients, neither muscle activity nor kinematics during jump landing has ever been assessed. Therefore, the aim of this study was to compare neuromuscular control mechanisms and kinematics between sub-acute ankle sprain patients and healthy persons prior to and during the initial contact phase of a 25 centimeters single-leg jump.

Fifteen patients and fifteen healthy persons performed three single-leg jumps. Electromyographic (EMG) activity of the m. gastrocnemius lateralis, m. tibialis anterior and m. peroneus longus as well as kinematics for ankle, knee and hip joint were recorded for pre-initial contact phase, post-initial contact phase and reflex-induced phase.

EMG activity of the three muscles did not differ between ankle sprain patients and healthy persons for any of the analyzed time intervals (all $p > 0.050$). However, ankle sprain patients showed a more dorsiflexed position ($1.03° ± 5.20°$) of the ankle joint during the post-initial contact phase compared to healthy persons ($-3.11° ± 5.66°$) ($p = 0.046$). These kinematic alterations of the ankle joint can lead to neuromuscular control mechanism disturbances through which functional instability might arise.

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