

Safety Literature 12th December 2021

A reliable fall detection system based on analyzing the physical activities of older adults living in long-term care facilities

Saleh M, Abbas M, Prud'Homm J, Somme D, Jeannes RLB. IEEE Trans. Neural Syst. Rehabil. Eng. 2021; ePub(ePub): ePub.

(Copyright © 2021, IEEE (Institute of Electrical and Electronics Engineers))

DOI 10.1109/TNSRE.2021.3133616 **PMID** 34874864

Abstract

Fall detection systems are designed in view to reduce the serious consequences of falls thanks to the early automatic detection that enables a timely medical intervention. The majority of the state-of-the-art fall detection systems are based on machine learning (ML). For training and performance evaluation, they use some datasets that are collected following predefined simulation protocols i.e. subjects are asked to perform different types of activities and to repeat them several times. Apart from the quality of simulating the activities, protocol-based data collection results in big differences between the distribution of the activities of daily living (ADLs) in these datasets in comparison with the actual distribution in real life. In this work, we first show the effects of this problem on the sensitivity of the ML algorithms and on the interpretability of the reported specificity. Then, we propose a reliable design of an ML-based fall detection system that aims at discriminating falls from the ambiguous ADLs. The latter are extracted from 400 days of recorded activities of older adults experiencing their daily life. The proposed system can be used in neck- and wrist-worn fall detectors. In addition, it is invariant to the rotation of the wearable device. The proposed system shows 100% of sensitivity while it generates an average of one false positive every 25 days for the neck-worn device and an average of one false positive every 3 days for the wrist-worn device.

Language: en

Advice by mail is as effective as targeted interventions in preventing injuries from falls

Saul H, Gursul D. BMJ 2021; 375: n2929.

(Copyright © 2021, BMJ Publishing Group)

DOI 10.1136/bmj.n2929 **PMID** 34872913

Abstract

This NIHR Alert is based on: Lamb S, Bruce J, Hossain A. Screening and intervention to prevent falls and fractures in older people. N Engl J Med 2020;383:19. To read the full Alert, go to: <https://evidence.nihr.ac.uk/alert/postal-advice-prevents-fall-related-fractures/>.

Language: en

Analysis of center of pressure signals by using decision tree and empirical mode decomposition to predict falls among older adults

Liao FY, Wu CC, Wei YC, Chou LW, Chang KM. J. Healthc. Eng. 2021; 2021: e6252445.

(Copyright © 2021, Multi-Science)

DOI 10.1155/2021/6252445 **PMID** 34868527

Abstract

Falls put older adults at great risk and are related to the body's sense of balance. This study investigated how to detect the possibility of high fall risk subjects among older adults. The original signal is based on center of pressure (COP) measured using a force plate. The falling group includes 29 subjects who had a history of falls in the year preceding this study or had received high scores on the Short Falls Efficacy Scale (FES). The nonfalling group includes 47 enrollees with no history of falls and who had received low scores on the Short FES. The COP in both the anterior-posterior and mediolateral direction were calculated and analyzed through empirical mode decomposition (EMD) up to six levels. The following five features were extracted and imported to a decision tree algorithm: root-mean-square deviation, median frequency, total frequency power, approximate entropy, and sample entropy. The results showed that there were a larger number of statistically different feature parameters, and a higher classification of accuracy was obtained. With the aid of empirical mode decomposition, the average classification accuracy increased 10% and achieved a level of 99.74% in the training group and 96.77% in the testing group, respectively.

Language: en

Chronic pain in the frail elderly mediates sleep disorders and influences falls

Honda H, Ashizawa R, Kiriya K, Take K, Hirase T, Arizono S, Yoshimoto Y. Arch. Gerontol. Geriatr. 2021; 99: e104582.

(Copyright © 2021, Elsevier Publishing)

DOI 10.1016/j.archger.2021.104582 **PMID** 34847515

Abstract

AIM: Previous studies have highlighted the causation between chronic pain and falls in the elderly, but the mediator variables between chronic pain and falls in the frail elderly have not been identified. The purpose of this study was to identify the mediator variable of chronic pain and falls.

METHODS: This study is a prospective cohort study. Participants were 116 frail elderly individuals living in a community. Chronic pain (pain lasting more than 3 months) was assessed using a questionnaire, and the occurrence of falls was tracked using a falls calendar. Using logistic regression, a model was created with falls as the dependent variable and chronic pain and confounders as independent variables. The mediation analysis was conducted with chronic pain as the independent variable, falls as the dependent variable, and factors that showed significant differences between the chronic pain group and the non-chronic pain group as candidate mediators.

RESULTS: Even after adjusting for covariates, chronic pain significantly influenced the occurrence of falls (odds ratio: 3.004, 95% CI [1.226, 7.363], $p=0.016$). The results of mediation analysis showed a significant direct effect between chronic pain and falls, and a significant indirect effect (partial mediation) of sleep disorders on the relationship between chronic pain and falls.

CONCLUSIONS: Chronic pain in frail elderly mediates sleep disorders and influences falls. It is suggested that interventions for chronic pain and sleep disorders should focus on preventing falls in the frail elderly.

Language: en

Keywords

Chronic pain; Fall; Frail elderly; Prospective studies; Sleep disorder

Comparison of the psychometric properties of three commonly used fall risk assessment tools: a prospective observational study for stroke patients

Arslan, Tosun Z. Top. Stroke Rehabil. 2021; ePub(ePub): ePub.

(Copyright © 2021, Informa - Taylor and Francis Group)

DOI 10.1080/10749357.2021.2008598 **PMID** 34850668

Abstract

BACKGROUND: A reliable tool recommendation is needed to identify the risk of falling in hospitalized stroke patients.

OBJECTIVES: The aim of this study was to identify the most reliable fall risk assessment tool among the Morse Fall Scale (MFS), Itaki Fall Risk Scale (Itaki FRS) and Hendrich II Fall Risk Model (HIIFRM) for stroke patients.

METHODS: The study was planned as an observational prospective study. It was carried out over the period July-December 2018 with 125 stroke patients. The Functional Independence Measure (FIM), Itaki FRS, HIIFRM, and MFS were used for the study data. The fall risk and incidents of falling were monitored on a daily basis over the course of the patients' stay at the hospital. The differentiation between the fall risk tools was assessed with sensitivity-specificity analysis and the ROC curve.

RESULTS: The mean age of the research participants was 71.47 ± 11.16 years. It was determined that 9.6% of the patients fell at least once during the follow-up period, which was 8.66 ± 1.80 days on average. The sensitivity and specificity rates of the fall risk assessment tools were respectively 75.0% and 63.7% for the Itaki FRS, 83.3% and 50.4% for the HIIFRM, and 91.7% and 73.5% for the MFS. The cutoff points on the tools were 14 for the Itaki FRS, 4.5 for the HIIFRM, and 66.2 for the MFS.

CONCLUSION: MFS is a more reliable tool than Itaki FRS or HIIFRM in determining fall risk in hospitalized stroke patients.

Language: en

Keywords

risk assessment; Stroke; fall; sensitivity; specificity

Differences in walking-to-turning characteristics between older adult fallers and nonfallers: a prospective and observational study using wearable inertial sensors

Yeh TT, Liang PJ, Lee SC. Int. J. Rehabil. Res. 2021; ePub(ePub): ePub.

(Copyright © 2021, Lippincott Williams and Wilkins)

DOI 10.1097/MRR.0000000000000511 **PMID** 34860731

Abstract

Wearable inertial sensors have gradually been used as an objective technology for biomechanical assessments of both healthy and pathological movement patterns. This paper used foot-worn sensors for characterizing the spatiotemporal characteristics of walking and turning between older fallers and nonfallers. Thirty community-dwelling older fallers and 30 older nonfallers performed 10-m straight walking, turned 180° around a cone, and then walked 10-m back to the starting point. Specific algorithms were used to measure spatiotemporal gait (double support phase of the gait cycle, swing width, and minimal toe clearance) and turning parameters (turn duration and turn steps) using two foot-worn Physiolog inertial sensor system. The researchers directly exported data as reported by the system. Our findings indicated that older fallers showed 26.58% longer time ($P = 0.036$) and 13.21% more steps ($P = 0.038$) compared to nonfallers during turning. However, both groups decreased their walking velocity (both $P < 0.001$), increased double support (both $P = 0.001$), and increased the swing width (both $P = 0.001$) during the transition from walking to turning. The older nonfallers additionally increased toe clearance ($P = 0.001$). Compared with the fallers, the older nonfallers showed a larger change in the swing width ($P = 0.025$) and toe clearance ($P = 0.025$) in walking to turning. Older fallers may adopt a cautionary strategy while turning to reduce the risk of falls. Wearable sensors can provide the temporospatial characteristics of turning and reveal significant differences by fall status, indicating the potential of turning measures as possible markers for identifying those at fall risk.

Language: en

Differentiating fallers from nonfallers using nonlinear variability analyses of data from a low-cost portable footswitch device: a feasibility study

Gonabadi AM, Antonellis P, Malcolm P. Acta Bioeng. Biomech. 2021; 23(2): 139-145.

(Copyright © 2021, Oficyna Wydawnicza Politechniki Wrocławskiej)

DOI unavailable PMID 34846047

Abstract

PURPOSE: Falls are one of the main causes of injuries in older adults. This study evaluated a low-cost footswitch device that was designed to measure gait variability and investigates whether there are any relationships between variability metrics and clinical balance tests for individuals with a history of previous falls.

METHODS: Sixteen older adults completed a history of falls questionnaire, three functional tests related to fall risk, and walked on a treadmill with the footswitch device. We extracted the stride times from the device and applied two nonlinear variability analyses: coefficient of variation and detrended fluctuation analysis.

RESULTS: The temporal variables and variability metrics from the footswitch device correlated with gold-standard measurements based on ground reaction force data. One variability metric (detrended fluctuation analysis) showed a significant relationship with the presence of past falls with a sensitivity of 43%.

CONCLUSION: This feasibility study demonstrates the basis for using low-cost footswitch devices to predict fall risk.

Language: en

Dynapenic abdominal obesity and the effect on long-term gait speed and falls in older adults

Zhang L, Liu S, Wang W, Sun M, Tian H, Wei L, Wu Y. Clin. Nutr. 2021; 41(1): 91-96.

(Copyright © 2021, Elsevier Publishing)

DOI 10.1016/j.clnu.2021.11.011 **PMID** 34864458

Abstract

BACKGROUND: Although both dynapenia and abdominal obesity have negative impact on physical function and health, few prospective studies evaluate the association of dynapenic abdominal obesity (D/AO) with gait speed and falls. Our aim was to examine the combined effect of low muscle strength and abdominal obesity on long-term gait speed and falls in older adults.

METHODS: We used longitudinal data from the English Longitudinal Study of Ageing (ELSA), including 4987 individuals aged 60 years and over. Grip strength and waist circumference were measured at baseline. Gait speed and fall events (falls, recurrent falls, and fall-related injury) were evaluated during a 14-year follow-up. The study population were divided into nondynapenic nonabdominal obesity (ND/NAO), nondynapenic abdominal obesity (ND/AO), dynapenic nonabdominal obesity (D/NAO), and D/AO, according to the sex-specific grip strength (<16 kg for women and <26 kg for men) and waist circumference (>88 cm for women and >102 cm for men). We used generalized estimating equation (GEE) model with gait speed as the outcome and cox proportional hazards models with fall events as the outcome.

RESULTS: GEE model showed that gait speed decreased during the 14-year follow-up in all groups (all $P(\text{time}) < 0.001$). Participants with ND/AO, D/NAO, and D/AO at baseline exhibited a worse gait speed than those with ND/NAO (all $P(\text{group}) < 0.001$). No significant difference in the rate of gait speed decline between four groups was found ($P(\text{group} \times \text{time}) = 0.062$). Cox regression analysis showed that D/NAO and D/AO highly predicted falls, and the hazard ratio (HR) was 1.181 (95% CI: 1.002, 1.392) for D/NAO and 1.195 (95% CI: 1.006, 1.421) for D/AO. D/AO was the unique condition associated with recurrent falls and fall-related injury, and the HRs were 1.276 (95% CI: 1.018, 1.599) and 1.348 (95% CI: 1.066, 1.704), respectively.

CONCLUSION: Dynapenia abdominal obesity, determined by low grip strength and high waist circumference, exhibits worse gait speed and increases the risk of fall events in older adults. Effort to maintain the mobility should focus on improving muscle strength and reducing excess body fat.

Language: en

Keywords

Falls; Longitudinal study; Abdominal obesity; Dynapenia; Gait speed

Effect of hypoxic conditioning on functional fitness, balance and fear of falling in healthy older adults: a randomized controlled trial

Timon R, Camacho-Cardenosa M, González-Custodio A, Olcina G, Gusi N, Camacho-Cardenosa A. *Eur. Rev. Aging Phys. Activ.* 2021; 18(1): e25.

(Copyright © 2021, Holtzbrinck Springer Nature Publishing Group)

DOI 10.1186/s11556-021-00279-5 **PMID** 34852758

Abstract

BACKGROUND: Hypoxic conditioning has been proposed as a new tool to mitigate the sarcopenia and enhance health-related function, but decrements in standing balance have been observed during hypoxia exposure. The aim of the study was to evaluate the effect of a hypoxic conditioning training on functional fitness, balance and fear of falling in healthy older adults.

METHODS: A total of 54 healthy older adults (aged 65-75 years), who voluntarily participated in the study, were randomly divided into three groups: the control group (CON), the normoxia training group (NT) that performed strength training in normoxia, and the hypoxia training group (HT) that trained under moderate hypoxic conditions at a simulated altitude of 2500 m asl. The training programme that was performed during 24 weeks was similar in both experimental groups and consisted of a full-body workout with elastic bands and kettlebells (three sets × 12-15 reps). The Senior Fitness Test (SFT), the Single Leg Stance test (SLS) and the Short Falls Efficacy Scale-International (FES-I) were assessed before and after the intervention.

RESULTS: Results showed that after training, either in normoxia or in hypoxia, the participants increased upper and lower body strength, and the aerobic endurance, and decreased the fear of falling.

CONCLUSIONS: The moderate hypoxic conditioning seems to be a useful tool to increase the functional capacity in healthy older adults without observing a decline in balance.

TRIAL REGISTRATION: ClinicalTrials.gov NCT04281264. Registered February 9, 2019-Retrospectively registered.

Language: en

Keywords

Older adults; Fitness; Falling; Hypoxia; Strength training

Implementation and initial evaluation of falls risk reduction resources in a rural Native American Community

Knight KM. Inj. Epidemiol. 2021; 8(Suppl 2): 66.

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DOI 10.1186/s40621-021-00359-1 **PMID** 34872622

Abstract

BACKGROUND: Although falls are common and can cause serious injury to older adults, many health care facilities do not have falls prevention resources available. Falls prevention resources can reduce injury and mortality rates. Using the Centers for Disease Control and Prevention's (CDC) Stopping Elderly Accidents, Deaths & Injuries (STEADI) model, a falls risk clinic was implemented in a rural Indian Health Service (IHS) facility.

METHODS: A Fall Risk Questionnaire was created and implemented into the Provider's Electronic Health Records system interface to streamline provider screening and referral of patients who may be at risk for falls to a group falls risk reduction class.

RESULTS: Participants exhibited average improvements in the Timed Up and Go (6.8 s) ($P = 0.0001$), Five-Time Sit-to-Stand (5.1 s) ($P = 0.0002$), and Functional Reach (3.6 inches) ($P = 1.0$) tests as compared to their own baseline.

RESULTS were analyzed via paired t test. 71% of participants advanced out of an "increased risk for falls" category in at least one outcome measure. Of the participants to complete the clinic, all were successfully contacted and three (18%) reported one or more falls at the 90-day mark, of which one (6%) required a visit to the Emergency Department but did not require hospital admission.

CONCLUSIONS: In regards to reducing falls in the community, per the CDC STEADI model, an integrated approach is best. All clinicians can play a part in reducing elder falls.

Language: en

Keywords

Falls; Community clinic; Falls risk; Falls risk screening

Investigating relationships between balance confidence and balance ability in older adults

Thompson LA, Badache M, Brusamolín JAR, Savadkoohi M, Guise J, de Paiva GV, Suh P, Sanchez Guerrero P, Shetty D. J. Aging Res. 2021; 2021: e3214366.

(Copyright © 2021, Hindawi)

DOI 10.1155/2021/3214366 **PMID** 34868684

Abstract

Increasing balance confidence in older individuals is important towards improving their quality of life and reducing activity avoidance. Here, we investigated if balance confidence (perceived ability) and balance performance (ability) in older adults were related to one another and would improve after balance training. The relationship of balance confidence in conjunction with balance performance for varied conditions (such as limiting vision, modifying somatosensory cues, and also base of support) was explored. We sought to determine if balance confidence and ability, as well as their relationship, could change after several weeks of training. Twenty-seven healthy participants were trained for several weeks during standing and walking exercises. In addition, seven participants with a higher risk of imbalance leading to falls (survivors of stroke) were also trained. Prior to and after training, balance ability and confidence were assessed via the Balance Error Scoring System (BESS) and Activities Specific Balance Confidence (ABC) Scale, respectively. Both groups showed improvements in balance abilities (i.e., BESS errors significantly decreased after training). Balance confidence was significantly higher in the healthy group than in the stroke group; however, ABC results reflected that balance confidence did not significantly increase after training for each. The correlations between balance ability and balance confidence were explored. Encouragingly, healthy participants displayed a negative correlation between BESS errors and ABC (i.e., enhancements in balance confidence (increases in ABC Scale results) were related to improvements in balance ability (decreases in BESS errors)). For the stroke participants, despite improvements in balance ability, our results showed that there was no relation to balance confidence (i.e., no correlation between BESS errors and ABC) in this group.

Language: en

Knee symptom but not radiographic knee osteoarthritis increases the risk of falls and fractures: results from the Osteoarthritis Initiative

Cai G, Li X, Zhang Y, Wang Y, Ma Y, Xu S, Shuai Z, Peng X, Pan F. Osteoarthritis Cartilage 2021; ePub(ePub): ePub.

(Copyright © 2021, Osteoarthritis Research Society International, Publisher Elsevier Publishing)

DOI 10.1016/j.joca.2021.11.015 **PMID** 34863991

Abstract

OBJECTIVE: To describe the effect of knee symptoms and radiographic osteoarthritis (ROA) on the risk of falls, recurrent falls, and fractures.

DESIGN: Participants from the Osteoarthritis Initiative were classified as having 'no', 'unilateral' or 'bilateral' knee symptoms (≥ 19 on a 0-96 Western Ontario and McMaster Universities Osteoarthritis Index) and ROA (Kellgren-Lawrence grade ≥ 2) for each visit. Self-reported falls and fractures in the past 12 months were extracted at baseline and follow-up visits until month 96. Recurrent falls were defined as having ≥ 2 falls in the past 12 months. Hazard ratios (HR) with 95% confidence intervals (CI) were estimated using mixed-effects complementary log-log regression.

RESULTS: Of 4465 participants, 3145 (70%), 1681 (38%), and 806 (18%) experienced at least one fall, recurrent fall, and fracture, respectively, over 96 months. Compared to participants without symptomatic knee, unilateral and bilateral knee symptoms were associated with a 17% increased risk of falls and a 36%-46% increased risk of recurrent falls, and bilateral knee symptoms increased the risk of fractures (HR 1.45, 95%CI 1.17 to 1.81). Compared to participants with no ROA in either knee, bilateral ROA was associated with a reduced risk of falls (HR 0.87, 95%CI 0.77 to 0.99) and fractures (HR 0.78, 95%CI 0.64 to 0.96). No statistically significant interactions between knee symptoms and ROA were observed.

CONCLUSIONS: This large population-based study showed that knee symptoms but not ROA increased the risk of falls, recurrent falls, and fractures, and that adults with bilateral ROA may have a lower risk of falls and fractures.

Language: en

Keywords

Fracture; Fall; Knee symptom; Osteoarthritis; Radiographic

Seasonal variation in fall-related emergency department visits by location of fall - United States, 2015

Kakara RS, Moreland BL, Haddad YK, Shakya I, Bergen G. J. Saf. Res. 2021; 79: 38-44.

(Copyright © 2021, U.S. National Safety Council, Publisher Elsevier Publishing)

DOI 10.1016/j.jsr.2021.08.002 **PMID** 34848018

Abstract

INTRODUCTION: In the United States, fall-related emergency department (ED) visits among older adults (age 65 and older) have increased over the past decade. Studies document seasonal variation in fall injuries in other countries, while research in the United States is inconclusive. The objectives of this study were to examine seasonal variation in older adult fall-related ED visits and explore if seasonal variation differs by the location of the fall (indoors vs. outdoors), age group, and sex of the faller.

METHODS: Fall-related ED visit data from the National Electronic Injury Surveillance System-All Injury Program were analyzed by season of the ED visit, location of the fall, and demographics for adults aged 65 years and older.

RESULTS: Total fall-related ED visits were higher during winter compared with other seasons. This seasonal variation was found only for falls occurring outdoors. Among outdoor falls, the variation was found among males and adults aged 65 to 74 years. The percentages of visits for weather-related outdoor falls were also higher among males and the 65-74 year age group.

CONCLUSIONS: In 2015, there was a seasonal variation in fall-related ED visits in the United States. Weather-related slips and trips in winter may partially account for the seasonal variation. **PRACTICAL IMPLICATIONS:** These results can inform healthcare providers about the importance of screening all older adults for fall risk and help to identify specific patients at increased risk during winter. They may encourage community-based organizations serving older adults to increase fall prevention messaging during winter.

Language: en

Keywords

Falls; Winter; Older adults; Elderly; Indoor; Outdoor

The body in old age and its relationships with falls from the narrative of elderlies

Estrêla ATC, Machin R. Cien. Saude Colet. 2021; 26(11): 5681-5690.

(Copyright © 2021, Associacao Brasileira de Pos-Graduacao em Saude Coletiva)

DOI 10.1590/1413-812320212611.30472020 **PMID** 34852100

Abstract

The purpose of this research was to investigate the body in old age and its relationships with falls. It was based on the assumption that the body is a historical, social and cultural construction, and that the idea of old age has been replaced by the idea of third age. Falls are considered a complex event with serious consequences for the elderly. The objective of the study was to investigate the experience of the body at old age and its relationships with falls. Using a qualitative method, semi-structured interviews were conducted with 15 individuals, 68 to 75 years old, with or without history of falls, who attended a geriatric outpatient clinic at a hospital autarchy in the city of São Paulo, from September 2017 to June 2018. The interviews were transcribed and an analysis of their content was made. The results showed a body which is experienced as the expression of an essence that is desired and is projected as a young one and falling becomes a reflection of old age and the exposure of a failure. The body experience does not seem to interfere directly with the risk of falls. However, its comprehension, as well as the representation of falls in old age, provides support to a preventive approach to this event.

Language: en

The impact of obesity and age on the risk of falls in elderly women

Bobowik P, Wiszomirska I. Acta Bioeng. Biomech. 2021; 23(2): 123-130.

(Copyright © 2021, Oficyna Wydawnicza Politechniki Wrocławskiej)

DOI unavailable PMID 34846051

Abstract

PURPOSE: The aim of this study was to examine the effect of obesity and age on body balance disorders in women over 60, especially whether obesity increases the FR in older females and whether age and obesity affect the same stabilographic parameters when it comes to the FR.

METHODS: The study consisted of 56 inactive females aged 71.77 ± 7.43 (SD). They were divided into groups according to age and obesity.

RESULTS: Obesity separately affects FRI12-6, static indicators with eyes closed (OSI EC, APSI EC, MLSI EC), and age affects FRI12-6 and static indices with eyes open (OSI EO, APSI EO). After considering design factors (age and obesity), there were statistically significant differences in OSI EO ($p = 0.027$), APSI EO ($p = 0.034$), FRI12-6 ($p = 0.0002$) between obese and non-obese participants in the age groups. There were no statistical differences between non-obese old and obese-young participants ($p = 0.863$). The interaction between obesity and age in the FR in static indices and in FRI12-6 ($p = 0.73047$) was not significant.

CONCLUSIONS: Age and obesity affect the stabilographic parameters individually, but there is no interaction effect between them. The presence of only one of the above risk factors may increase the FR. Obesity affects stability, while age depends on other factors. If older people are not obese or fit, involutional changes could be reversed. The type of obesity and the location of the fat tissue should be taken into account in FR assessment.

Language: en

Toe support pattern as a new predictive factor associated with falls in older people with psychiatric disorders

Pico AMP, Sánchez MJ, Tejedor FM, Acevedo RM. J. Am. Podiatr. Med. Assoc. 2021; 111(5): e10.

(Copyright © 2021, American Podiatric Medical Association)

DOI 10.7547/20-135 **PMID** 34861691

Abstract

BACKGROUND: Maintaining autonomy is one of the principal objectives for seniors and people with psychiatric disorders. Podiatric medical care can help them maintain autonomy. This work aimed to characterize and quantify the support of the toes in a psychiatric population by analyzing the influence of psychotropic medications and toe and foot support parameters on the prevalence of falls.

METHODS: We conducted a cross-sectional descriptive study in 67 participants (31 people with psychiatric disorders and 36 without diagnosed disorders [control population]). Toe support pattern was analyzed with a pressure platform. Variables were measured in static and dynamic loading and related to falls and psychotropic medication use.

RESULTS: The psychiatric population fell more than the control population and presented less toe-ground contact in static measurements, although it has more foot-ground contact time. Maximum toe pressure during toe-off is also less intensive in the psychiatric population and is related to people who take psychotropic medications.

CONCLUSIONS: Toe support pattern could be used as a predictive factor for falls and to improve stability in these populations.

Language: en

Investigating the underlying biomechanical mechanisms leading to falls in long-term ankle-foot orthosis and functional electrical stimulator users with chronic stroke

Nevisipour M, Honeycutt CF. Gait Posture 2021; 92: 144-152.

(Copyright © 2021, Elsevier Publishing)

DOI 10.1016/j.gaitpost.2021.11.025 **PMID** 34847412

Abstract

BACKGROUND: Ankle-foot-orthoses (AFOs) and functional electrical stimulators (FES) are commonly prescribed to treat foot-drop in individuals with stroke. Despite well-established positive impacts of AFO and FES devices on balance and gait, AFO and FES-users still fall at a high rate.

OBJECTIVE: The objective of this study was to investigate 1) the underlying biomechanical mechanisms leading to a fall in long-term AFO and FES-users with chronic stroke and 2) the impacts of AFOs and FES devices on fall outcomes and compensatory stepping response of long-term users with chronic stroke.

METHODS: Fall outcomes as well as kinematics and kinetics of compensatory stepping response of 42 individuals with chronic stroke (14 AFO-users, 10 FES-users, 18 Non-users) were evaluated during trip-like treadmill perturbations. AFO and FES-users were evaluated with and without their device.

RESULTS: Chronic AFO and FES-users fell 2.50 and 2.77 times more than Non-users. The most robust differences between AFO/FES-users and Non-users were 1) Reduced capacity to stabilize the trunk through reduction in forward whole-body angular momentum and 2) diminished capability to prepare and generate a second step using the paretic leg. Provocatively, the removal of AFO and FES devices did not decrease/increase falls or change kinematics. **SIGNIFICANCE:** It is well-established that AFOs/FES devices have a positive impact on static balance and decrease community falls by increasing toe clearance thus preventing trips/stumbles. However, our results suggest that once a trip occurs, these devices do not adequately assist recovery of balance. Specifically, current AFO and FES devices do not assist with second step generation or trunk control. Future studies should explore new devices or training paradigms that target enhancing trunk control and paretic compensatory stepping to decrease falls in this population.

Language: en

Keywords

Stroke rehabilitation; Ankle foot orthosis; Fall biomechanics; Functional electrical stimulation; Reactive stepping response

Microprocessor knee technology reduces odds of incurring an injurious fall for individuals with diabetic/dysvascular amputation

Wurdeman SR, Miller TA, Stevens PM, Campbell JH. Assist. Technol. 2021; ePub(ePub): ePub.

(Copyright © 2021, Rehabilitation Engineering and Assistive Technology Society of North America, Publisher Informa - Taylor and Francis Group)

DOI 10.1080/10400435.2021.2010147 **PMID** 34870561

Abstract

Individuals with lower limb amputation have a high incidence of falls. An above-the-knee amputation and diabetes/vascular disease are both risk factors for falls. Microprocessor knee (MPK) technology may reduce falls in this population. The objective was to determine the association of MPKs and reduced injurious falls. A retrospective analysis of injurious falls within a large, national outcomes database was conducted. Inclusion was limited to adult K3 ambulators with unilateral, transfemoral or knee disarticulation amputation due to diabetes/vascular disease. There were 744 out of 881 individuals that did not receive an MPK.

RESULTS showed that 16.3% of non-MPK users experienced an injurious fall compared to 7.3% of MPK users ($p=0.007$). Not having an MPK resulted in significantly increased odds (unadjusted: OR: 2.47, 95% CI: 1.26 - 4.83, $p=0.009$; adjusted for confounders: OR: 2.52, 95% CI: 1.28 - 4.94, $p=0.007$) of incurring an injurious fall over a 6-month period. In conclusion, the current study found use of an MPK strongly associated with reduced injurious falls in a population of patients with amputation due to diabetes/vascular disease. The findings strongly support the use of MPK technology to mitigate fall risk, and in particular injurious falls requiring medical intervention.

Language: en

Keywords

falls; rehabilitation research; diabetes; Prosthesis design; transfemoral amputation; vascular disease