

SafetyLit November 25, 2018**Comparison of accelerometry-based features for fall risk assessment measured from two sensor locations**

Immonen M, Simila H.

Conf. Proc. IEEE Eng. Med. Biol. Soc. 2018; 2018: 2076-2079.

(Copyright © 2018, IEEE (Institute of Electrical and Electronics Engineers))

DOI 10.1109/EMBC.2018.8512713 **PMID** 30440811**Abstract**

Falls are an unfortunate problem for older adults, their relatives and societies. Continuous gait monitoring for fall risk assessment during daily lives would allow early interventions to prevent injurious falls. Continuous gait monitoring is possible using technological solutions such as inertial sensors; for example accelerometers. Current solutions require attaching the sensor to a certain location on the body and many of them to the lower back, which is not convenient for the user. The objective of this study was to find out whether gait variables calculated from the acceleration signal measured during walk from two different locations on waist area differ from each other. Forty two older adult subjects were measured during walk test with a triaxial acceleration sensor worn on an elastic belt at the lower back and frontal hip area. Most of the analyzed gait features from the two locations have a strong correlation, indicating that these features are not sensitive to sensor location around waist level. A subsequent study is needed to confirm other locations for the sensors to allow analyzing gait during everyday lives.

PDF Y Endnote Y**Eigen posture based fall risk assessment system using Kinect**

Tripathy SR, Chakravarty K, Sinha A.

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DOI 10.1109/EMBC.2018.8513263 **PMID** 30440310**Abstract**

Postural Instability (PI) is a major reason for fall in geriatric population as well as for people with diseases or disorders like Parkinson's, stroke etc. Conventional stability indicators like Berg Balance Scale (BBS) require clinical settings with skilled personnel's interventions to detect PI and finally classify the person into low, mid or high fall risk categories. Moreover these tests demand a number of functional tasks to be performed by the patient for proper assessment. In this paper a machine learning based approach is developed to determine fall risk with minimal human intervention using only Single Limb Stance exercise. The analysis is done based on the spatiotemporal dynamics of skeleton joint positions obtained from Kinect sensor. A novel posture modeling method has been applied for feature extraction along with some traditional time domain and metadata features to successfully predict the fall risk category. The proposed unobstrusive, affordable system is tested over 224 subjects and is able to achieve 75% mean accuracy on the geriatric and patient population.

PDF Y Endnote Y**Factors associated with older adults' enrollment in balance classes to prevent falls: case-control study**

Currie DW, Thoreson SR, Clark L, Goss CW, Marosits MJ, DiGuseppi CG.

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(Copyright © 2018, Sage Publications)

DOI 10.1177/0733464818813022 **PMID** 30451055

Abstract

Balance training decreases fall risk among older adults, but few participate in such training. We examined the association of exposure to social marketing to promote balance classes, personal characteristics and other factors, with older adults' balance class participation. Adults aged ≥ 60 years were eligible for this case-control study if they attended any church enrolled in a trial testing the effect of social marketing on balance class participation. Cases attended balance classes during the study period; controls were randomly sampled congregants who did not join a class. Cases were more likely to attend churches that received the social marketing program, and were older, more often female, and more frequently experienced "near falls" than controls. Participation was also associated with increasing age of the church's leader and rural church attendance. Programs to promote balance classes may need to be tailored to target some risk groups, including men and urban and suburban congregants.

PDF Y Endnote Y

Geriatric distal femoral fractures: a retrospective study of 30 day mortality

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Injury 2018; ePub(ePub): ePub.

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(Copyright © 2018, Elsevier Publishing)

DOI 10.1016/j.injury.2018.10.035 **PMID** 30442373

Abstract

INTRODUCTION: Distal femoral fractures have many of the same challenges as hip fractures, but there has been limited research into outcomes following these. The aim of this study was to assess 30 day mortality following distal femoral fractures in comparison to hip fractures presenting to a single institution. Secondary outcomes included risk factors for mortality, post-operative complications and union.

METHODS: A retrospective case series of all distal femoral fragility fractures in patients over 65, and hip fractures over a 5 year period at a single institution.

RESULTS: 88 distal femoral fractures and 2837 hip fractures fulfilled the inclusion criteria. In the distal femoral fractures there were 80 females and 8 males with a mean age of 82.4 (range 65-103). The mean age of the hip fractures was 83.7 (range 65-106) and there were 2066 females and 771 males. The overall 30 day mortality for hip fractures was 7.7% and was 9.1% for distal femoral fractures. The risk ratio was 1.1777(95% CI 0.6009-2.3080) ($p = 0.6338$). There was no significant difference in 30 day mortality between the two fracture types. Of the 88 distal femoral fractures 75 (85.2%) underwent open reduction internal fixation, 5 (5.7%) intramedullary nail and 8 (9.1%) conservative treatment. 11.4% suffered a medical complication. 9.1% patients required at least 1 further surgical procedure. The union rate was 94.3%. The 1 year mortality was 34.1%.

CONCLUSIONS: There is no significant difference in 30 day mortality between distal femoral and hip fractures. Distal femoral fractures occur in a complex group of patients that is similar to hip fractures. They have high mortality and complication rates.

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HOLOBALANCE: an Augmented Reality virtual trainer solution for balance training and fall prevention

Kouris I, Sarafidis M, Androutsou T, Koutsouris D.

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(Copyright © 2018, IEEE (Institute of Electrical and Electronics Engineers))

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Abstract

Balance disorders affect a large number of older people, leading to falls. To promote independence, self-care and the quality of living of the long-lived population, an innovative solution is developed to act as a virtual trainer for people that suffer from vestibular dysfunction related balance disorders. Our solution offers a virtual balance therapy, supported by Information and Communication Technology devices, to monitor user's activity during the day and provide real time feedback for the correct execution of physiotherapy exercises. Wearable sensors are utilized to monitor user activity, while during the execution of exercises, cameras are used to track the body of the user. An Augmented Reality headset is used to project the virtual trainer's 3D avatar in front of the user, providing real time guidance for the correct execution of the exercises.

PDF Y Endnote Y

Is it feasible to deliver a complex intervention to improve the outcome of falls in people with dementia? A protocol for the DIFRID feasibility study

Allan LM, Wheatley A, Flynn E, Smith A, Fox C, Howel D, Barber R, Homer TM, Robinson L, Parry SW, Corner L, Connolly JA, Rochester L, Bamford C.

Pilot Feasibility Stud. 2018; 4: e170.

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DOI 10.1186/s40814-018-0364-7 PMID 30455976 PMCID PMC6230281

Abstract

BACKGROUND: People with dementia (PWD) experience ten times as many incident falls as people without dementia. Little is known about how best to deliver services to people with dementia following a fall. We used an integrated, mixed-methods approach to develop a new intervention which combines theory generated via a realist synthesis and data on current provision and pathways, gathered through a prospective observational study as well as qualitative interviews, focus groups and ethnographic observation. This intervention is to be tested in a feasibility study in the UK National Health Service.

METHODS: People living with dementia in one of three geographical areas will be eligible for the study if they experience a fall requiring healthcare attention and have an informal carer. Potential participants will be identified by community services (primary care, paramedics, telecare), secondary care (ED, facilitated discharge services, rehabilitation outreach teams) and research case registers. Participants will receive a complex multidisciplinary intervention focused on their goals and interests for up to 12 weeks. The intervention will be delivered by occupational therapists, physiotherapists and rehabilitation support workers. Feasibility outcomes will include recruitment and retention, suitability and acceptability of outcome measures and acceptability, feasibility and fidelity of intervention components. PWD outcome measures will include number of falls, Montreal Cognitive Assessment (MOCA), European Quality of Life Instrument (EQ-5D-5L), Quality of Life-Alzheimer's Disease Scale (QOL-AD), Modified Falls Efficacy Scale (MFES) and Goal Attainment Scaling (GAS). PWD outcome measures completed by an informal carer will include Disability Assessment for Dementia (DAD), EQ-5D-5L Proxy, QoL-AD Proxy and a Health Utilisation Questionnaire (HUQ). The carer outcome measure will be the Zarit Burden Interview (ZBI). An embedded process evaluation will explore barriers and facilitators to recruitment and intervention delivery.

DISCUSSION: The study results will inform whether and how a larger multicentre RCT should be undertaken. A full RCT would have the potential to show how outcomes can be improved for people



with dementia who have fallen. ETHICS AND DISSEMINATION: The National Research Ethics Service Committee Newcastle and North Tyneside 2 approved the feasibility study. TRIAL REGISTRATION: International Standard Randomised Controlled Trial Registry. Registration number: ISRCTN41760734. Date of registration: 16/11/2015.

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Mobile fall risk assessment solution for daily-life settings

Simila H, Immonen M, Niemirepo T.

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Abstract

Prevention of falls requires accurate means for fall risk assessment in order to identify persons at risk. This paper introduces a novel mobile fall risk assessment solution for daily-life settings. The solution contains an Android application that uses acceleration sensor data received via Bluetooth LE connection. The application guides through a simple walk test, analyzes the acceleration data measured from the acceleration sensor attached to the lower back and gives feedback about the fall risk for the user. Preliminary user tests with 12 healthy subjects were conducted to evaluate the feasibility of the solution. Each test subject performed three walks demonstrating normal, dragging and slow gait. The results showed that the acceleration features calculated by the application distinguish normal gait from dragging and slow gaits. Further collection of comprehensive data set with older adults is needed to adjust the application parameters appropriately for the target group.

PDF Y Endnote Y

Non-pharmacological interventions for agitation/aggressive behaviour in patients with dementia: a randomized controlled crossover trial

Dimitriou TD, Verykoui E, Papatriantafyllou J, Konsta A, Kazis D, Tsolaki M.

Funct. Neurol. 2018; 33(3): 143-147.

(Copyright © 2018, CIC Edizioni Internazionali)

DOI unavailable **PMID** 30457967

Abstract

Agitation/aggressive behaviour is a common behavioural and psychological symptom in people with dementia (PwD), occurring with a frequency of between 13-50.4% according to recent studies, and the rate increases as the severity of cognitive decline increases. The burden on caregivers is considerable. This trial is a randomized controlled crossover trial conducted in Greece. The following measures were used: the Mini-Mental State Examination, Addenbrooke's Cognitive Examination Revised, Geriatric Depression Scale, Functional Rating Scale for Symptoms in Dementia and Neuropsychiatric Inventory. According to the results the most effective nonpharmacological intervention for reducing agitation/aggressive behaviour in PwD was music therapy, followed by aromatherapy and massage, and finally physical exercise.

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Participation in two evidence-based falls prevention programs by adults aging with a long-term disability: case-control study of reach and effectiveness

Eagen TJ, Teshale SM, Herrera-Venson AP, Ordway A, Caldwell J.

J. Aging Health 2018; ePub(ePub): ePub.

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DOI 10.1177/0898264318808918 PMID30442042

Abstract

OBJECTIVE: Adults aging with a long-term disability (LTD) are at an increased risk for falls. The Older Americans Act Title III-D and Prevention and Public Health Fund (PPHF) support several organizations to deliver falls prevention evidence-based programs designed to reduce risk factors; however, little is understood about the reach and effectiveness of these fall prevention programs for those with LTD compared to those without LTD. This study compared the reach and effectiveness of two evidence-based falls prevention programs between older adults with and without LTD.

METHOD: Using a matched case-control design, 105 LTD older adults enrolled in A Matter of Balance (AMOB) or Stepping On were matched to 315 non-LTD older adults on age, sex, race, and education.

RESULTS: On average, LTD older adults attended a higher number of class sessions and were significantly more likely to complete the program compared with the matched-sample of non-LTD older adults. LTD older adults were equally likely as non-LTD older adults to report significant reductions in self-reported fear of falling, falls-related activity restriction, and improvement in falls self-efficacy following completion of the programs.

DISCUSSION: These findings provide preliminary evidence for the effectiveness of these evidence-based falls prevention programs for LTD older adults; however, more research is needed to extend these findings.

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Pre-impact alarm system for fall detection using MEMS sensors and HMM-based SVM classifier

Liang S, Chu T, Lin D, Ning Y, Li H, Zhao G.

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Abstract

Accidental fall can cause physical injury, fracture and other health complication, especially for elderly people living alone. Aimed to provide timely assistance after the occurrence of falling down, a pre-fall alarm system was proposed. In order to test the reliability of pre-fall alarm system, eighteen subjects who worn this device on the waist were required to participate in a series of experiments. The acceleration and angular velocity time series extracted from human motion processes were used to describe human motion features. HMM-based SVM classifier was used to determine the maximum separation boundary between fall and Activities of Daily Living (ADLs). The fall detection results showed 94.91% accuracy, 97.22% Sensitivity and 93.75% Specificity. The proposed device can accurately recognize fall event, achieve additional functions, and have advantages of small size and low power consumption. Based on the findings, this pre-impact fall alarm system with detection algorithm could potentially be useful for monitoring the state of physical function in elderly population.

PDF Y Endnote Y

Predicting walking intentions using sEMG and Mechanical sensors for various environment

Kyeong S, Shin W, Kim J.

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Abstract



Predicting the motion intentions of a user is very challenging when controlling an exoskeleton robot. When only a mechanical sensor is used, a change in the motion is detected during the user's movement. An electromyographic (EMG) signal, which is a biological signal, is detected by the activation of the muscles before the actual movement of a person. Using the EMG signal, the motion intention can be identified before the actual movement, and the delay in time in controlling the exoskeletal robot can be shortened to reduce the resistance felt by the user. In this paper, the surface electromyographic (sEMG) signal is used together with a mechanical sensor to identify the walking environment according to the walking gait cycle. In the classification, the combination of sensors was varied, and information from one leg and two legs was analyzed by the different gait periods before and after heel contact and toe off. As a result of the classification into three sensor combinations, sEMG, kinetic, and kinematic sensors, at the pre heel contact time before walking, a 96.8% and 98.6% accuracy was obtained for information from one and two legs, respectively. In the same gait environment, it was shown that the gait prediction can be performed based on the time unit by dividing the time interval before starting the gait. An average accuracy of 84.4% was obtained when the time was divided by the environment in intervals of 100ms before heel contact, and the average was 90.9% when it was divided by an interval of 200ms before heel contact.

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Real-time action recognition and fall detection based on smartphone

Ning Y, Hu S, Nie X, Liang S, Li H, Zhao G.

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Abstract

This paper presents a smartphone application which has realized action recognition and fall detection. The application identifies the holding pattern of smartphone by the data of light sensor, distance sensor and accelerometer sensor, which reduce the impact of recognition resulting from the smartphone's different positions. And then the application uses data collected from the acceleration sensor, the direction angle sensor and the gyro sensor to distinguish fall from daily actions. The results of human motion recognition are uploaded to the server. For the purpose of real time, the network stability of the application is improved by the method of multi-layer detection based on heartbeat packet. Experiments prove that the way of improving network stability can reduce the rate of losing packet. The accuracy of action recognition achieves more than 90%.

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Reliability, validity, and ability to identify fall status of the Berg Balance Scale, Balance Evaluation Systems Test (BESTest), Mini-BESTest, and Brief-BESTest in older adults who live in nursing home

Viveiro LAP, Gomes GCV, Bacha JMR, Carvas Junior N, Kallas ME, Reis M, Jacob Filho W, Pompeu JE. *J. Geriatr. Phys. Ther.* 2018; ePub(ePub): ePub.

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(Copyright © 2018, American Physical Therapy Association)

DOI 10.1519/JPT.000000000000215 **PMID** 30407272

Abstract

BACKGROUND AND PURPOSE: In any given year, 28% to 35% of older adults experience falls. In nursing home environments, the annual rate of falls increases to 30% to 50%. Our objective was to verify and compare the reliability, validity, and ability to identify falls of the Berg Balance Scale (BBS), Balance Evaluation Systems Test (BESTest), Mini-BESTest, and Brief-BESTest for older adults who live



in nursing home.

METHODS: This was a cross-sectional study. Older adults ($n = 49$; aged 62-90 years; mean = 77.8; standard deviation = 7.2) were recruited from a nonprofit nursing home. All participants were assessed by 2 physiotherapists using the BBS, BESTest, Mini-BESTest, and Brief-BESTest. The interrater and test-retest (7-14 days) reliability were assessed using intraclass correlation coefficients (ICCs [2, 1]). Minimal detectable changes at the 95% confidence level were established. To analyze each test's ability to identify fall status, we used receiver operating characteristic (ROC) curves, whose statistical significance we verified using the area under the ROC curve (AUC) and respective 95% confidence intervals (CIs). The diagnostic likelihood ratios (positive and negative) and 95% CI were used to verify posttest probability. We used Fagan's nomogram to show the posttest probability of each balance test. Validity was assessed using kappa coefficients and the prevalence-adjusted bias-adjusted kappa (PABAK).

RESULTS: Interrater and test-retest reliability for the total scores were good to excellent across all 4 tests (ICC interrater value = 0.992-0.994 and ICC test-retest value = 0.886-0.945). All tests were also able to identify fall status (AUC = 0.712-0.762) and were in good agreement with each other (kappa coefficient for individuals with fall risk = 0.679-0.957 and individuals with no fall risk = 0.135-0.143; PABAK = 83.7%-98%).

CONCLUSION: All balance tests presented similar reliability, reproducibility, and validity. This suggests that any of these tests can be used in clinical practice. However, the Brief-BESTest is the quickest and easiest test to perform.

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The impact of freezing of gait on balance perception and mobility in community-living with Parkinson's disease

Mancini M, Curtze C, Stuart S, El-Gohary M, James, McNames, Nutt JG, Horak FB.

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Abstract

This pilot study investigated the impact of freezing of gait, objectively measured with three inertial sensors, on mobility function during seven days of communityliving monitoring in people with Parkinson's disease. Twenty-four subjects with PD, of which 14 experiencing freezing of gait, were recruited in this study. Subjects wore three inertial sensors (Opals, APDM) attached to both feet and the lumbar region for a week of continuous monitoring. Walking bouts, of at least 10s, were first identified, and then features of freezing, quantity and quality of mobility were extracted and averaged across the seven days.

RESULTS showed significant impairments in freezing and quality of mobility in the freezers group compared to the nonfreezers. Our measures of average and variability of time spent freezing was associated to the subjects' perception of freezing, assessed with the New Freezing of Gait Questionnaire. These preliminary results are introducing promising measures of mobility impairments measured during community-living in PD.

PDF Y Endnote Y

The minimum clinically important difference (MCID) for a falls intervention in Parkinson's: a Delphi study

Henderson EJ, Morgan GS, Amin J, Gaunt DM, Ben-Shlomo Y.

Parkinsonism Relat. Disord. 2018; ePub(ePub): ePub.



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DOI 10.1016/j.parkreidis.2018.11.008 **PMID** 30455158

Abstract

BACKGROUND: Falls are common in Parkinson's disease so any intervention that reduced falls risk would be of value. One potential intervention is the use of cholinesterase inhibitor (ChEi) drugs.

OBJECTIVE: To establish the minimum clinically important difference (MCID) for fall rates to inform the effect estimate for sample size calculations of future clinical trials.

METHODS: We performed a Delphi study assembling a panel of experts in Parkinson's disease from academic and clinical medicine in order to reach a consensus of opinion. Responses from a panel were summarised and resent to the group, until consensus was reached.

RESULTS: 780 clinicians, who had been caring for people with Parkinson's for an average of 14 years, were contacted via three routes. The median (Interquartile range (IQR)) MCID after round 1 was 25% (IQR 20-30%) which equates to the prevention of 5 (IQR 4-6) falls per year. Increasing consensus after round two confirmed the MCID of 25%, narrowing the (IQ) range to 20%-25%. This was unchanged when the panel were shown the number of participants that would need to be recruited to a clinical trial in order to achieve this difference.

CONCLUSIONS: We have established that an expert panel of PD specialists consider that an intervention that demonstrated a 25% (IQR 20-25%) relative reduction in falls rate would be clinically meaningful. This estimate can be used to help determine the sample size for any future clinical trial.

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What factors contribute to falls-related distal radius fracture?

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J. Aging Phys. Act. 2018; ePub(ePub): ePub.

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(Copyright © 2018, Human Kinetics Publishers)

DOI 10.1123/japa.2017-0428 **PMID** 30452300

Abstract

METHODS:: A sample of 1453 patients (430 men; 1023 women; age range: 18 to 89 years) supplemented by new interview data from 29 patients (19 women) were examined. Chi-square and descriptive analysis of quantitative data, descriptive thematic analysis of qualitative data were compared to determine data convergence and divergence.

RESULTS:: A higher number of DRF were observed in the 45 to 64-year-old group (44%), employed people (48%), in winter months (41%) and in low energy fractures (75%). Themes emerged from qualitative data on the cause of the fracture included: environmental factors, behavioural factors, physical factors and sports activities.

CONCLUSION:: Reasons for DRF are multifactorial. Preventive strategies with an emphasis on environmental and behavioural factor modifications are likely to decrease the number of DRF.

PDF Y Endnote Y



Young and aged blunt trauma patients display major differences in circulating inflammatory mediator profiles after severe injury

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J. Am. Coll. Surg. 2018; ePub(ePub): ePub.

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(Copyright © 2018, American College of Surgeons, Publisher Elsevier Publishing)

DOI 10.1016/j.jamcollsurg.2018.10.019 **PMID** 30448299

Abstract

BACKGROUND: Aging is accompanied by alterations in immune functions. How these changes translate into levels of circulating inflammatory mediators and network expression after severe trauma is not well characterized. To address this, we compared time-dependent changes in the levels of an extensive biomarker panel in cohorts of severely injured young and aged adults. **STUDY DESIGN:** Cohorts of young (18-30 years old, n=115) and aged (65-90 years old, n=101) blunt trauma patients admitted to the intensive care unit (ICU) with plasma sampled 3 times within the first 24 hours and daily from day (D)1 to D7 were assayed for 30 inflammatory biomarkers using Luminex™. Stringently matched groups controlling for sex ratio and injury severity score [ISS] (n = 56 young vs. n = 56 aged) were generated. Data were analyzed using 2-way ANOVA, area under the curve (AUC) analysis, Dynamic Bayesian Network (DyBN) inference, and Dynamic Network Analysis (DyNA).

RESULTS: In the overall cohorts, the young group had a significantly higher ISS, which was associated with higher circulating levels of 18 inflammatory mediators from admission to D7. The aged group had higher levels of C-X-C motif chemokine 10/interferon gamma-induced protein 10 (CXCL10/IP-10) and chemokine ligand 9/monokine induced by gamma interferon (CXCL9/MIG). In groups that were matched for ISS, the significantly higher levels of IP-10 and MIG persisted in the aged. DyBN revealed IP-10 and MIG as key mediators in the aged, while DyNA revealed higher network complexity in the aged.

CONCLUSIONS: These findings indicate that differences in the early inflammatory networks between young and aged trauma patients are not simply a suppression of pro-inflammatory responses in the aged, but are characterized by a major shift in the mediator profile patterns with high levels of CXC chemokines in the aged.

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PDF Y Endnote Y

A new smart balance rehabilitation system technology platform: development and preliminary assessment of the Smarter Balance System for home-based balance rehabilitation for individuals with Parkinson's disease

Fung A, Lai EC, Lee BC.

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(Copyright © 2018, IEEE (Institute of Electrical and Electronics Engineers))

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Abstract

Physical and balance rehabilitation programs have been shown to improve postural stability and balance performance and to be more effective than dopaminergic medication and surgical treatments for individuals with Parkinson's disease (PD). This paper describes the development and assessment of a new Smarter Balance System (SBS) intended for home-based use by individuals with PD. We report the initial results of a long-term study currently underway that quantifies the clinical impacts of using the SBS during a 6-week, home-based rehabilitation program. Preliminary results



indicate that individuals with PD improved their balance and postural stability, and maintained the improvements for 1 month after completing the 6-week, homebased rehabilitation program with the SBS.

PDF Y Endnote Y

A sensor fusion approach for inertial sensors based 3D kinematics and pathological gait assessments: toward an adaptive control of stimulation in post-stroke subjects

Sijobert B, Feuvrier F, Froger J, Guiraud D, Coste CA.

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(Copyright © 2018, IEEE (Institute of Electrical and Electronics Engineers))

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Abstract

Pathological gait assessment and assistive control based on functional electrical stimulation (FES) in post-stroke individuals, brings out a common need to robustly quantify kinematics facing multiple constraints. This study proposes a novel approach using inertial sensors to compute dorsiflexion angles and spatio-temporal parameters, in order to be later used as inputs for online close-loop control of FES. 26 post-stroke subjects were asked to walk on a pressure mat equipped with inertial measurement units (IMU) and passive reflective markers. A total of 930 strides were individually analyzed and results between IMU-based algorithms and reference systems compared. Mean absolute (MA) errors of dorsiflexion angles were found to be less than 4°, while stride lengths were robustly segmented and estimated with a MA error less than 10 cm. These results open new doors to rehabilitation using adaptive FES closed-loop control strategies in "foot drop" syndrome correction.

PDF Y Endnote Y

Daytime sleepiness affects gait auditory synchronization ability

Umemura GS, Pinho JP, Forner-Cordero A.

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Abstract

Sleep disturbances in modern life lead to cognitive and motor performance impairments in everyday tasks such as gait. The most common symptom of these disturbances is daytime sleepiness, which can be assessed by questionnaires such as the Epworth Sleep Scale (ESS). The ESS evaluates sleep health and daytime dysfunction. The goal of this study is to assess the influence of sleepiness on a motor-auditory synchrony task, rhythmed gait. High and low sleepiness clusters were formed based on the participants ESS scores. Walking on a treadmill, two different rhythmic auditory stimulus conditions were set with a metronome: isochronous and non-isochronous. Reflective markers on both heels with seven infrared cameras were used to assess the difference between footfall and metronome beep, what is named synchronization error (SE). There was a tendency to anticipate the beep in the HS group when compared to the LS group only in the non-isochronous stimulus condition that was statistically significant. Sleep disturbances that generate daytime sleepiness may bring detrimental effects on brain areas that could be responsible for the real-time adjustment of gait and sustained attention. These impairments may be responsible for the larger synchronization error with larger relative phase of the group with high sleepiness. More studies are necessary involving other parameters of sleep and gait to identify sleep disturbances through gait analysis.

PDF Y Endnote Y



Identification of Parkinson's disease utilizing a single self-recorded 20-step walking test acquired by smartphone's inertial measurement unit

Mehrang S, Jauhiainen M, Pietil J, Puustinen J, Ruokolainen J, Nieminen H.

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DOI 10.1109/EMBC.2018.8512921 **PMID** 30441010

Abstract

Parkinson's disease (PD) is a degenerative and long-term disorder of the central nervous system, which often causes motor symptoms, e.g., tremor, rigidity, and slowness. Currently, the diagnosis of PD is based on patient history and clinical examination. Technology-derived decision support systems utilizing, for example, sensor-rich smartphones can facilitate more accurate PD diagnosis. These technologies could provide less obtrusive and more comfortable remote symptom monitoring. The recent studies showed that motor symptoms of PD can reliably be detected from data gathered via smartphones. The current study utilized an open-access dataset named "mPower" to assess the feasibility of discriminating PD from non-PD by analyzing a single self-administered 20-step walking test. From this dataset, 1237 subjects (616 had PD) who were age and gender matched were selected and classified into PD and non-PD categories. Linear acceleration (ACC) and gyroscope (GYRO) were recorded by built-in sensors of smartphones. Walking bouts were extracted by thresholding signal magnitude area of the ACC signals. Features were computed from both ACC and GYRO signals and fed into a random forest classifier of size 128 trees. The classifier was evaluated deploying 100-fold cross-validation and provided an accumulated accuracy rate of 0.7 after 10k validations. The results show that PD and non-PD patients can be separated based on a single short-lasting self-administered walking test gathered by smartphones' built-in inertial measurement units.

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Interference of visual conditions and stance postures on center of pressure sway in patients with schizophrenia with history of fall

Chern JS, Wang SP, Chang JH, Yu SN, Lin YZ.

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Abstract

This study examines the interaction effects among incidences of falls, visual conditions, and stance postures on the magnitude of center of pressure sway (MCOPS) in patients with schizophrenia. The coordinates of COP in ten postural control demands were measured in subjects with at least one or without any falls in the previous year. MCOPS was calculated by the default program in Balance 3.78 software. Cognitive functions were also measured. The findings include: (1) the MCOPS increased as the postural control demands increase in subjects who have fallen; (2) MCOPS in subjects without falls was the largest for the lowest postural control demands; (3) MCOPS increased when the eyes were closed in subjects without a history of falls but decreased in subjects with a history of falls; (4) cognition function in subjects who have fallen was inferior to that in those without falls. The interference visual condition and stance postures on MCOPS tended to be different in schizophrenia with or without incidences of falls indicating the possible association between psychomotor dysfunction and falls in the subjects.

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Ophthalmic conditions associated with inpatient falls among veterans

Campagna G, Chamberlain P, Orenge-Nania S, Biggerstaff K, Khandelwal S.

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DOI 10.1097/OPX.0000000000001312 **PMID** 30451809

Abstract

SIGNIFICANCE: Efforts to describe the relationship between pathological visual impairment and fall risk are typically confined to community dwellers. Among admitted patients, however, the associations are less understood. Fall risk assessment tools are used in some clinical settings, but most do not capture the suspected importance of ophthalmic pathologies in predicting the likelihood of an inpatient fall.

PURPOSE: The purpose of this study was to determine the association between ophthalmic conditions and inpatient falls at the Michael E. DeBakey Veterans Affairs Medical Center (MEDVAMC), where vision and ophthalmic conditions are not considered when assessing fall risk.

METHODS: This is a population-based, retrospective case-control study of 805 patients admitted to the MEDVAMC in January 2014 who had also visited the MEDVAMC Eye Clinic within 1 year of admission. The patients' eye examinations, ophthalmic diagnoses, and other indicators of constitutive health were compared between 60 patients who experienced an inpatient fall ("cases") and 749 patients who did not ("controls"). Significant differences between the cases and the controls were determined using logistic regression models.

RESULTS: Baseline demographics were similar among the two groups. Ophthalmic conditions associated with an increased incidence of inpatient falls included age-related macular degeneration (odds ratio, 3.9; 95% confidence interval, 1.5 to 9.9; $P = .008$) and a presenting visual acuity of worse than 20/40 in the better-seeing eye (odds ratio, 2.0; 95% confidence interval, 1.0 to 4.1; $P = .04$). Those without falls demonstrated a better mean presenting visual acuity in the better-seeing eye compared with those who fell (logMAR, 0.12 ± 0.23 vs. 0.28 ± 0.49 , $P < .001$).

CONCLUSIONS: In this population, age-related macular degeneration and poor presenting visual acuity in the better-seeing eye are associated with increased incidence of inpatient falls. An assessment of visual function and ophthalmic diagnoses may be warranted upon admission to the hospital for increased prevention of inpatient falls.

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Postural balance performance of children with ADHD, with and without medication: a quantitative approach

Sarafpour M, Shirazi SY, Shirazi E, Ghazaei F, Parnianpour Z.

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Abstract

Attention Deficit Hyperactivity Disorder (ADHD) significantly impairs the performance of students during their early school years. However, the extent of the difference in postural stability between children with ADHD and Typically Developed (TD) children, are still not fully understood. Also, it is clinically important to investigate possible effects of medication on their performances. We recruited 38 children between the ages 6 to 12 with ADHD (15 medically naïve, 23 with current treatment history) and 25 age-matched as TD. Postural stability performance was assessed in four conditions: 1-eyes open, 2-eyes closed, 3-eyes open on foam and 4-eyes closed on foam. A cost-



effective mobile force platform was used to evaluate postural performance quantitatively. RESULTS revealed a lower stability performance in the medically-naïve participants especially in trials with eyes open on foam. No significant difference in performance was seen between children with medical treatment history and the TD group.

RESULTS suggest that using medication can effectively enhance postural stability for children with ADHD. We found portable balance assessment tools helpful in identifying changes in motor performances among children with ADHD. Our results indicate that further research is needed to understand the exact implications of ADHD on postural stability under different sensory stimuli.

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Transfer learning approach for fall detection with the FARSEEING real-world dataset and simulated falls

Silva J, Sousa I, Cardoso J.

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Abstract

Falls are very rare and extremely difficult to acquire in free living conditions. Due to this, most of prior work on fall detection has focused on simulated datasets acquired in scenarios that mimic the real-world context, however, the validation of systems trained with simulated falls remains unclear. This work presents a transfer learning approach for combining a dataset of simulated falls and non-falls, obtained from young volunteers, with the real-world FARSEEING dataset, in order to train a set of supervised classifiers for discriminating between falls and non-falls events. The objective is to analyze if a combination of simulated and real falls could enrich the model. In the real-world, falls are a sporadic event, which results in imbalanced datasets. In this work, several methods for imbalance learning were employed: SMOTE, Balance Cascade and Ranking models. The Balance Cascade obtained less misclassifications in the validation set. There was an improvement when mixing the real falls and simulated non-falls compared to the case when only simulated falls were used for training. When testing with a mixed set with real falls and simulated non-falls, it is even more important to train with a mixed set. Moreover, it was possible to conclude that a model trained with simulated falls generalize better when tested with real falls, than the opposite. The overall accuracy obtained for the combination of different datasets were above 95 %.

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Use of average vertical velocity and difference in altitude for improving automatic fall detection from trunk based inertial and barometric pressure measurements

Musngi MM, Aziz O, Zihajehzadeh S, Nazareth GC, Tae CG, Park EJ.

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Abstract

Despite the extensive research that has been carried out on automatic fall detection using wearable sensors, falls in the elderly cannot be detected effectively yet. Although recent fall detection algorithms that evaluate the descent, impact and post impact phases of falls, often using vertical velocity, vertical acceleration and trunk angle respectively, tend to be more accurate than the algorithms that do not consider them, they still lack the desired accuracy required to be used among frail older adults. This study aims to improve the accuracy of fall detection algorithms by incorporating average vertical velocity and difference in altitude as additional parameters to the



vertical velocity, vertical acceleration and trunk angle parameters. We tested the proposed algorithms on data recorded from a comprehensive set of falling experiments with 12 young participants. Participants wore waist-mounted accelerometer, gyroscope and barometric pressure sensors and simulated the most common types of falls observed in older adults, along with near-falls and activities of daily living (ADLs). Our results showed that, while the base algorithm with the three parameters provided 91.8% specificity, the addition of difference in altitude and average vertical velocity improved the specificity to 98.0% and 99.6%, respectively.

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