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Video game play-based motor learning-induced brain adaptations in the elderly

Submission date
16/09/2015

Recruitment status
No longer recruiting

Registration date
17/09/2015

Overall study status
Completed

Last Edited
01/12/2016

Condition category
Other

[_] Prospectively registered
[_] Protocol
[_] Statistical analysis plan
[X] Results
[_] Individual participant data

Plain English summary of protocol

Background and study aims
The brain is made up of billions of nerve cells called neurons, which use electrical signals to communicate with each other. When a large group of these neurons fire simultaneously, “brainwaves” are produced. There are four main types of brainwave, one of which being alpha waves. Alpha waves are produced in the brain’s “default” state, and are typically present when a person is physically or mentally relaxed. Recent studies have shown that during physical exercise, the amount of alpha waves in the brain dramatically increases. In professional athletes, it has been shown that a burst of alpha waves often accompanies peak physical performance. It has therefore been suggested that stimulating the production of alpha waves could improve physical performance in non-athletes. Practicing mental exercises such as mindfulness (paying more attention to the present), increases levels of alpha waves in the prefrontal cortex (PFC) of the brain. This part of the brain is responsible for thinking, decision making and attention, as well as co-ordinating other parts of the brain. This could therefore mean that stimulating alpha wave production in this part of the brain while exercising could increase physical performance. The aim of this study is to find out whether a videogame combining movement and mental exercises can improve physical performance by stimulating alpha wave production.

Who can participate?
Healthy adults aged 65 or over, living independently or in a community residence.

What does the study involve?
Participants are randomly allocated into one of two training programmes. Training sessions take place for 30 minutes, three times a week for both groups. The first training programme incorporates physical and mental exercises using a virtual-reality video game. Participants in this group follow instructions on a screen to complete a range of mental exercises, as well as standing on a pressure-sensitive platform while completing movements in time with the game. The second training programme focuses on physical activity alone. Participants in this group complete a number of balance exercises which vary in difficulty. Before the training programmes begin and after 8 weeks of training, participants have their alpha wave activity measured using a brain scanning device while they complete cognitive and physical tests. Participants in both groups also complete questionnaires to assess their mental faculties and physical fitness at these timepoints.

What are the possible benefits and risks of participating?
Participants may benefit from improved physical and cognitive fitness after taking part. There are no specific risks involved with participating in the study.

Where is the study run from?
Alterssiedlung Irchel, Zurich (Switzerland)

When is the study starting and how long is it expected to run for?
May 2015 to September 2015

Who is funding the study?
1. Swiss Federal Institute of Technology (ETH), Zurich (Switzerland)
2. Institute of Human Movement Sciences and Sport (Switzerland)

Who is the main contact?
Dr Eling D. de Bruin

Contact information

Type(s)
Scientific

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Additional identifiers

EudraCT/CTIS number

IRAS number

ClinicalTrials.gov number

Secondary identifying numbers
N/A

Study information

Scientific Title
Video game play-based motor learning-induced prefrontal neuronal adaptations in the elderly

Study objectives
Video game based physical exercise is more effective in stimulating prefrontal neuronal activity (alpha waves) during motor (gait performance) and cognitive (executive tests) performance than conventional sensorimotor balance skill training in the elderly.

Ethics approval required
Old ethics approval format

Ethics approval(s)
ETH Zurich Ethics Committee (Switzerland), 19/05/2015, ref: EK 2015-N-10

Study design
Single-center randomized controlled intervention trial

Primary study design
Interventional

Secondary study design
Randomised controlled trial

Study setting(s)
Other

Study type(s)
Quality of life

Participant information sheet
No participant information sheet available

Health condition(s) or problem(s) studied
Geriatrics related conditions of independently living and community dwelling in the elderly

Interventions
Participants follow an eight week guided training intervention. Training sessions take place three times per week for thirty minutes. Participants are randomly allocated to two training groups with different training programs. Participants are accustomed slowly to the exercise and are continuously monitored by the instructors. The intensity of both training groups is increased progressively.
1. Intervention group (video game training):
Participants execute virtual-reality video game training. They follow the step instructions presented on a screen in front of them. The games target different cognitive domains, e.g. divided attention or inhibition. Movements have to be carried out with the rhythm of the video game. Participants stand on a pressure-sensitive platform which records right and wrong movements.
2. Control group (sensorimotor balance skill training)
Participants perform traditional balance exercises that consist of repetitive exercises

challenging balance strategies. Participants perform conventional static and dynamic exercises on stable and unstable surfaces. Difficulty of the exercise are varied using bipedal or monopedal stance, opening or closing eyes, causing perturbation or using a motion platform.

Intervention Type

Primary outcome measure
All measures are assessed pre-intervention and after 8 weeks of training:
1. Headcoach™ Pocket EEG measures prefrontal alpha-activity during cognitive test performance
1.1. Event-related potential (ERP) elicited by events of interest
2. Headcoach™ Pocket EEG measures prefrontal alpha-activity during gait performance
2.1. Alpha peak frequency
2.1.1. Preferred walking
2.1.2. Dual task walking at preferred speed
2.1.3. Fast walking
2.1.4. Dual task walking at fast speed

Secondary outcome measures
All measures are assessed pre-intervention and after 8 weeks of training.
3. Test for attentional performance (TAP) (reaction time and false response rate)
3.1 Working memory
3.2 Flexibility
3.3 Divided attention
3.4 Go/No-go
4. Temporal (time) and spatial (distance) gait parameters using Gaitup (Movement analysis and measurement)
4.1. Preferred walking
4.2. Dual task walking at preferred speed
4.3. Fast walking
4.4. Dual task walking at fast speed
5. Fear of falling: The Icon Fall Efficacy Scale (Icon-FES) measure “concern” about falling through the combination of pictures and matching short phases. The scale asses both easy and difficult activities and social activities containing 30 items with a 4-point scale (1 = not at all concerned, 2 = somewhat concerned, 3 = fairly concerned, 4 = very concerned).
6. Mini Mental Status (MMS) is a reliable and valid experiment to quantitative estimate the severity of cognitive impairment
7. Geriatric depression scale (GDS) is used to record symptoms of depression. The German version has a good validity and reliability.

Overall study start date
20/05/2015

Completion date
30/09/2015

Eligibility

Key inclusion criteria

1. Aged over 65 years
2. Signed informed consent statement
3. Healthy (self-reported)
4. Independently living or community dwelling

Participant type(s)
Healthy volunteer

Age group
Senior

Sex
Both

Target number of participants
30

Key exclusion criteria
1. Mobility or cognitive impairments (Mini Mental State examination below 22)
2. Rapidly progressive or terminal illness, acute illness or chronic illness
3. Alzheimer’s disease, dementia or recent head injury

Date of first enrolment
20/05/2015

Date of final enrolment
29/06/2015

Locations

Countries of recruitment
Switzerland

Study participating centre
Alterssiedlung Irchel
Möhrlistrasse 110
Zurich
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CH-8006

Sponsor information

Organisation
Swiss Federal Institute of Technology Zurich (ETH) (Switzerland)

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Sponsor type
University/education

ROR
https://ror.org/05a28rw58

Funder(s)

Funder type
University/education

Funder Name
Swiss Federal Institute of Technology (ETH), Zurich (Switzerland)

Funder Name
Institute of Human Movement Sciences and Sport (Switzerland)

Results and Publications

Publication and dissemination plan
We planned to start the dissemination of results at the start of October 2015 and we intend to publish at the beginning/middle of 2016.

Intention to publish date
30/06/2016

Individual participant data (IPD) sharing plan

IPD sharing plan summary
Available on request

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?

Basic results	results	02/09/2016	09/09/2016	No	No
Results article		23/11/2016		Yes	No