

HOLOGRAMS FOR PERSONALISED VIRTUAL COACHING IN BALANCE DISORDERS

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An update for clinicians

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“BRT can effectively reduce falls, as well as the fear of falling which impacts social life of older citizens”



Balance Rehabilitation Therapy

Older people assessed as being at increased risk of falling should have an individualized multifactorial intervention (National Institute for Clinical Excellence (NICE) 2017 guidelines).

Balance rehabilitation therapy (BRT) is a form of physical therapy that is a highly effective intervention for persons with disorders of the vestibular or central balance system, reducing both falls and the fear of falling. The basis for the success of BRT is the use of existing neural mechanisms in the human brain for adaptation, plasticity, and compensation. Specifically designed BRT exercise protocols take advantage of the plasticity of the brain to recalibrate vestibular reflexes and readjust motor and other responses. Other factors that affect the degree of individual compensation include overall physical status, the functional status of remaining sensory systems, integrity of central brain mechanisms, age, and higher functions such as memory, motor coordination, and cognitive ability.

The EU-funded HOLOBALANCE is a state of the art system providing a supervised, evidence-based, gradually progressive, multifactorial, individualized falls intervention, through cutting-edge technology and improving clinical practice.

Three different types of coaching will be provided by the HOLOBALANCE platform:

- balance physiotherapy
- cognitive training combined with auditory tasks
- multilevel motivation and physical activity promotion

Updating Clinical Practice

The following are recommendations and guidelines for older adults are based on the guideline reviews, systematic review, and meta-analysis the Consortium Clinical Partners.

Balance Physiotherapy

- Current guidelines recommend providing strength and balance training to community dwelling older adults who are at risk for falls. However, few guidelines provide specific details on which type of exercises within each category should be provided.
- When applying a model for postural stability to the current guidance for rehabilitation, only one third of domains are addressed. Future guidelines and research studies should attempt to use theoretical frameworks to support clinical decision making and address gaps in the research evidence.

Cognitive training

- Including cognitive training into falls rehabilitation programmes improves balance function and confidence. Cognitive training likely reduces the occurrence of falls, as balance function and confidence are correlated with falls.
- Cognitive function improves with cognitive training dosage, but levels off. Maximum improvement is seen when cognitive training is performed 3 times per week, for an hour per session.
- Various cognitive domains should be targeted, including executive function, memory, processing speed, attention, and visuospatial skills.
- Computer-based cognitive training is an effective and efficient training tool.

Dual Tasking

- Preliminary evidence shows that the inclusion of dual-task training improves balance and gait function. Including dual-task training into a balance rehabilitation programme showed greater improvement in balance function than standard exercise-based programmes.
- Using cognitive tasks for dual-task training improves ecological validity for balance training, reflecting more real-world demands during balance tasks. Various cognitive domains can be targeted. Evidence is lacking regarding the most effective tasks to include in the training.
- More evidence is required to determine the most effective task to include, as well as optimal dose of dual-task training to include within an overall balance training programme



Recommendations presented in the 19th IAPA Conference in Egypt - October 2018



Older citizen with balance disorder who tested the system and provided feedback at an early stage.

HOLOBALANCE Components

Coaching

HOLOBALANCE has designed, following a user-centred approach, has developed and currently evaluates, a radically novel, personalized and cost-effective virtual coach, for use at home with a portable head mounted device or at clinics and community settings with the projector-based Holobox, consisting of:

- a balance physiotherapist hologram and exergames interacting with the patient in real time
- wearable technology for the evaluation of the performance during rehabilitation therapy to guide the interaction
- augmented reality cognitive games, combined with auditory training tasks to supplement physiotherapy
- a physical activity planner



Behavioural change

For the HOLOBALANCE intervention to be successful, it is essential that participants are motivated to engage regularly and consistently with the exercise system and the associated interventions. In HOLOBALANCE, after reviewing relevant models and the needs of citizens with balance disorders, the Capability, Opportunity and Motivation (COM-B) model of behaviour (Michie et al, 2011) was adopted. The COM-B is a psychological model of behaviour change that can be used to identify factors related to successful behavioural change and specify targets to help modify health-related behaviour. Success in behaviour change will be assessed by measures embedded in the HOLOBALANCE intervention: how often and for how long participants are engaging with the technology and performing the exercises. Motivation will be directly measured at baseline and at the end of the intervention with the exercise regulations questionnaire (BREQ-3).



Proof of concept study

The aims of the single assessor, blinded, pilot, randomised controlled, proof of concept study (Trial Registration Number - NCT04053829) are to:

- 1) determine the safety, acceptability and feasibility of providing HOLOBALANCE to community dwelling older adults at risk for falls
- 2) provide data to support sample size estimates for a future trial should trends for effectiveness be identified.

This study has received institutional ethical approvals in UK (London, UCL, King's), Germany (University of Freiburg) and Greece (Athens, Ippokratio).

Study conduct

Study participants will be independent community-dwelling older (age 65-80) citizens, without cognitive problems, able to walk 500 meters independently or with a stick and being at risk of falls [i.e. Functional Gait Assessment (FGA) less than 22/30], have significant fear of falling [Falls Efficacy Scale International (Short FES-I) form >10] or having experienced a fall/s in the last 12 months.

At the 1st phase the stationary, projector-based HOLOBOX will be pilot tested as follows:

- 20 Participants, 10 randomised to the Holobox and 10 to the OTAGO control programme
- Assessment at baseline (week 0) and week 9 (end of training)
- Supervised Holobox training at clinic/lab/hospital twice weekly for 8 weeks (16 sessions in total)
- Each participant will be provided with an individualised programme of home exercises to practise on days NOT attending clinic for both intervention and control groups

At the 2nd phase the portable version of HOLOBALANCE will be evaluated:

- 120 Participants, 60 randomised to Holobalance and 60 to the OTAGO control programme

- Assessment at baseline (week 0) and week 9 (end of training) - assessments take place in a clinic/hospital setting
- Intervention and control group carry out entire exercise programme in home environment only, not in clinic for 8 weeks in total
- All participants will receive an exercise programme provided under the supervision of a physiotherapist with regular reviews by telephone (weekly) and home visits (Week 0,3 and 6).



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