

**Multisensory Action Observation a promising tool to improve freezing of gait in Parkinson's disease: preliminary data.**

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Because of its sudden and transient nature, Freezing of Gait (FoG) is one of the most disabling symptom, causing falls that negatively impacts on well-being and quality of life even if not all Parkinson patients experience it. Contrasting or no pharmacological responsiveness of FoG has led to an increasing interest in rehabilitation interventions, aimed at functional gait recovery.

Currently, the "best practice" employed for rehabilitation is based on attentional strategies, and on the use of temporal or spatial external stimuli (cues) to facilitate the initiation and ongoing motor activity. However, these strategies may generate an important dependence that implies to rely critically on cues in the environment. Moreover, in certain circumstances, cueing may trigger freezing episodes as dual task conditions. Re-Learning motor strategies without cues (i.e. using action observation [1]) can be an alternative/innovative approach to rehabilitation that relies more on appropriate allocation of attention and lightening cognitive load.

The aim of the study is to evaluate motor learning effects of a novel experimental rehabilitation protocol based on action observation, compared to a traditional protocol based on cues. The experimental protocol was intended to reduce freezing of gait symptoms in Patients with Parkinson disease (PwP).

The experimental protocol was based on action observation [2] plus sonification. Height motor gestures were re-learned using video-clips showing an actor performing the same gestures; patients watched the video-clips and then tried to repeat the gesture. Each video-clip was composed by images and sounds of the gestures. The sounds of gestures were obtained with the sonification technique, by transforming kinematic data (velocity) recorded during the execution of gesture, into pitch variations (for an example see: [bit.ly/sonif\\_example](http://bit.ly/sonif_example)). In the cue-based protocol, the same 8 motor gestures were re-learned using auditory, visual, and tactile stimulations. Functional and clinical scales were used to evaluated patients' motor performance and gait abilities before, immediately after, at 1 month, and 3 months after the treatment. With the same schedule, patients' kinematic and kinetic indices were assessed on three gait movements: walk, step initiation, and sit-to-step. These indices were compared with those of a normative sample of PwP and FoG [1].

Preliminary data on two patients showed that both protocols have positive effects on functional and clinical tests. Overall, in a comparison with a normative population, the

percent of kinetic and kinematic indices that changed in the 3 periods was larger in the experimental than in the cue-based protocol.

1. Pelosin E., Avanzino L., Bove M., Stramesi P., Nieuwboer A., Abbruzzese G (2010). Action observation improves freezing of gait in patients with Parkinson's disease. *Neurorehabilitation and Neural Repair*, 24:746-52
2. Mezzarobba S., Sgubin G., Grassi M., Valentini R., Bernardis P., (2015). Sit-to-Walk predicts Freezing of Gait status over than cognitive load: an experimental study with Linear Discriminant Analysis. In Bernardis P., Fantoni C. & Gerbino W. (Eds.), *Proceedings of the Trieste Symposium on Perception and Cognition* p. 27 Trieste: EUT