

# Analysis of upper limb movement in Multiple Sclerosis subjects during common daily actions

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## BACKGROUND

Upper limb impairments prevent to perform both simple tasks, as moving an object, and ADL (e.g. eating, dressing and grooming) in about 65% of people with MS (PwMS) [Santello et al. 2015; Cheunga et al. 2012], usually characterized by compromised muscle activation patterns, reduction in muscle strength, loss of coordination, tremor and fatigue. Thus, behavioral measures could improve the understanding of MS motor control alterations facilitating the design of novel rehabilitative treatments.

## AIM

Here, we proposed simple exercises to investigate and characterize upper limb motor performance and muscle activity in PwMS.

## MATERIALS AND METHODS

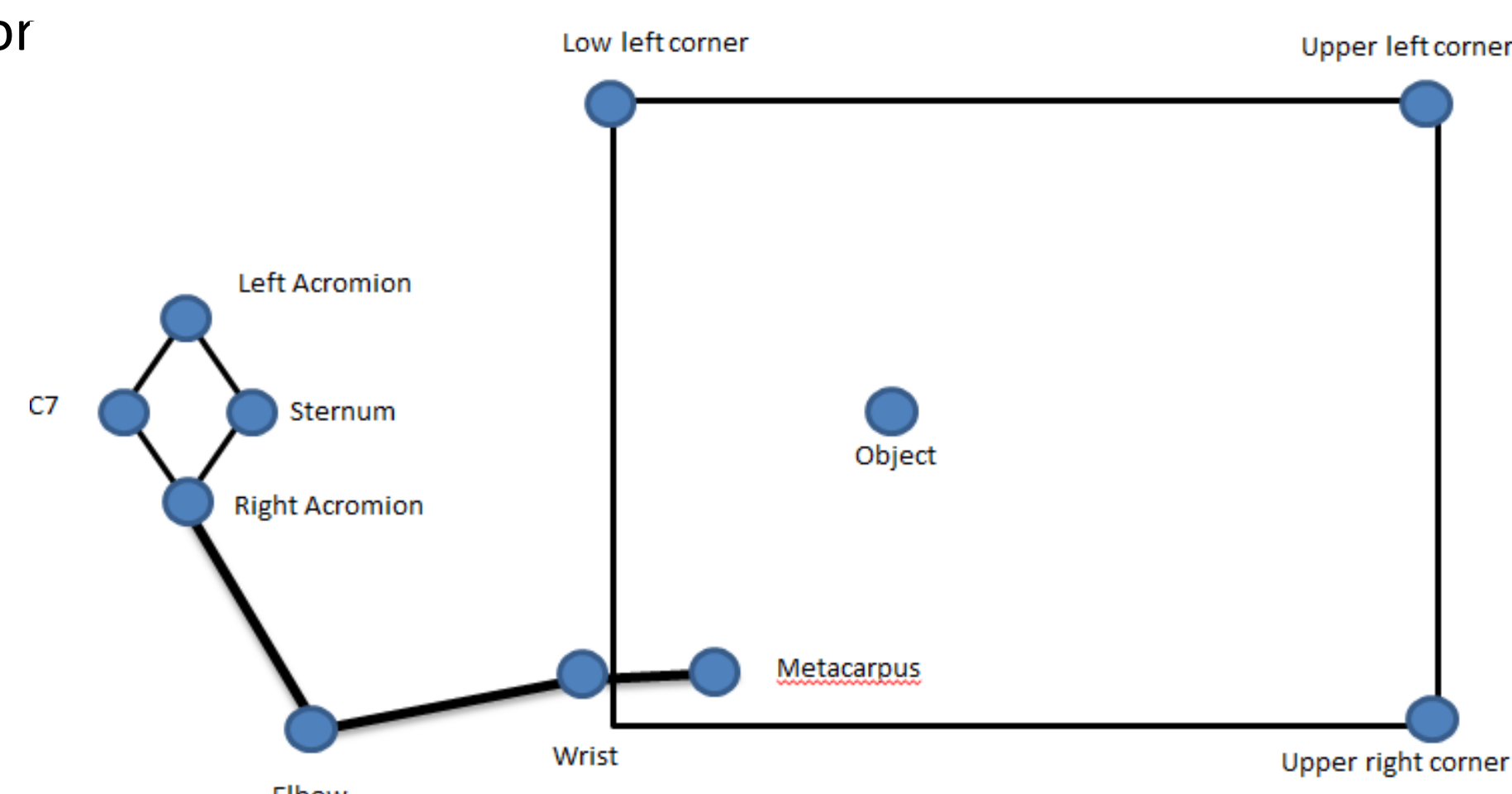
The subjects were seated in front of a table with the right hand in the right corner. At the "Go!" they had to grasp an object in front of them, bring it to their mouth, reposition the object in its original position and return her/his hand to the starting position.

The objects were:

- (i) two black varnished bottles filled at different levels (287 and 785 g);
  - (ii) a plastic glass;
  - (iii) a spoon placed in an empty plate.
- Both (ii) and (iii) were empty or filled with water.

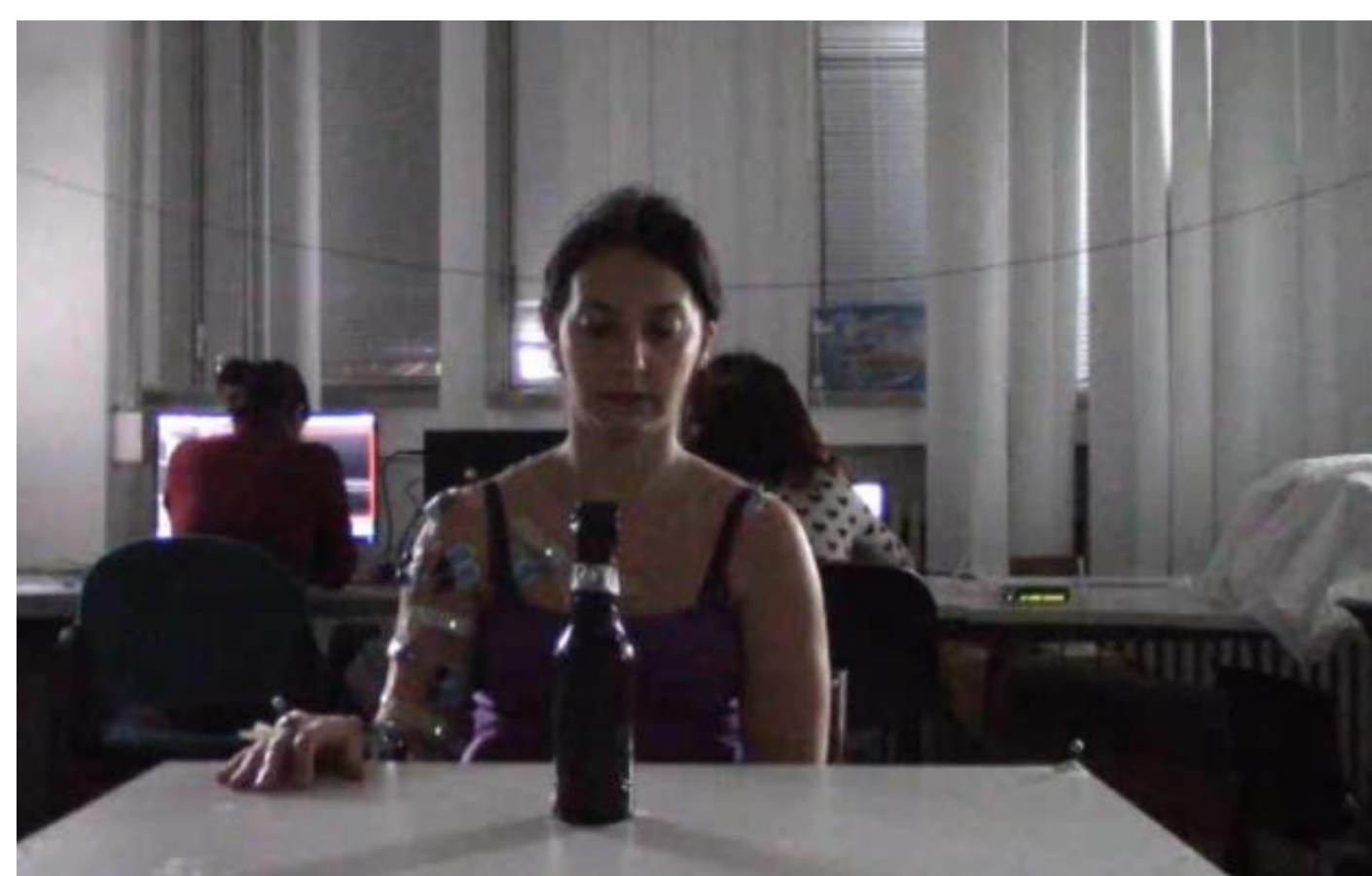
The subjects had to perform the task in the most natural way possible with the dominant upper limb. 10 trials for each condition were performed. The movements were evaluated with kinematics (markers placed on right acromion, left acromion, C7, sternum, elbow, wrist, metacarpus) and electromyography from 16 muscles:

- Deltoid anterior/medial/posterior
- Biceps brachii head short/long
- Triceps brachii head long/lateral
- Brachioradialis
- Brachialis
- Flexor carpi radialis
- Extensor carpi radialis
- Latissimus dorsi
- Rhomboideus
- Infrapinatus
- Pectoralis major
- Upper trapezius



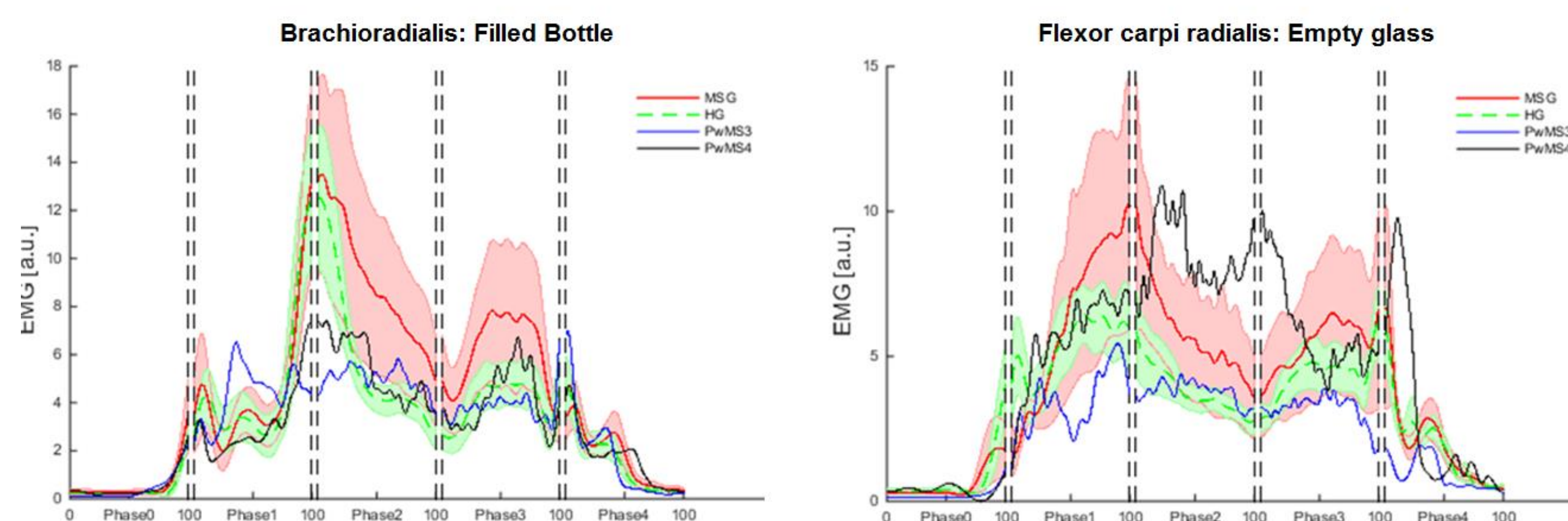
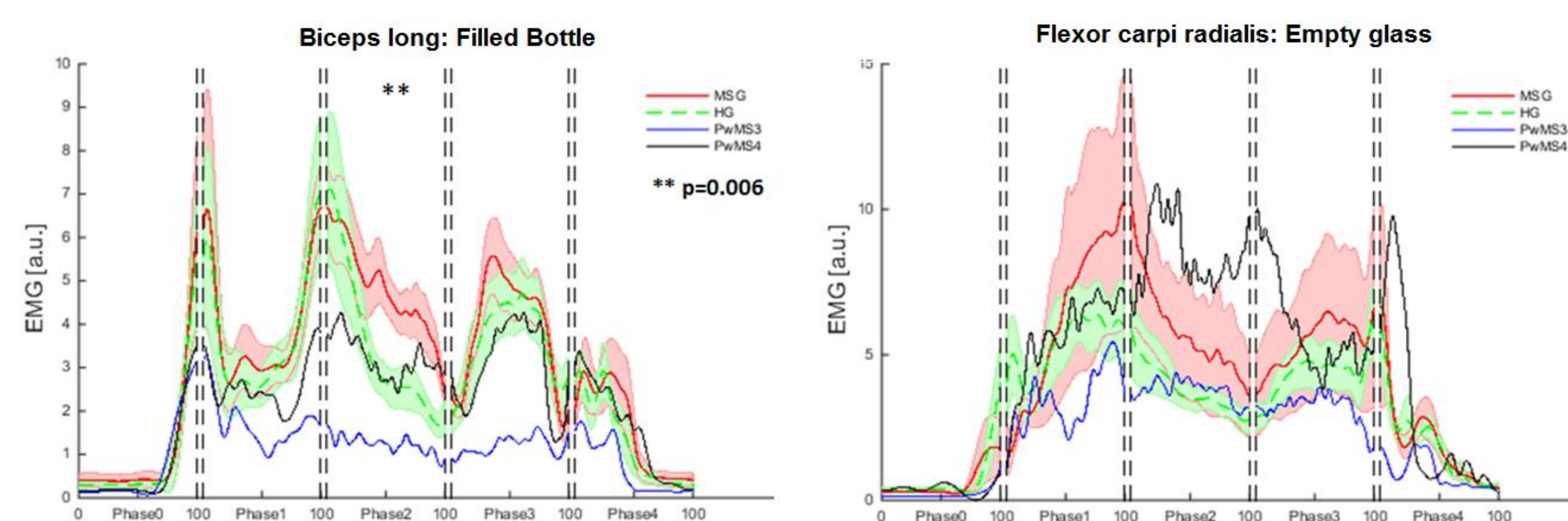
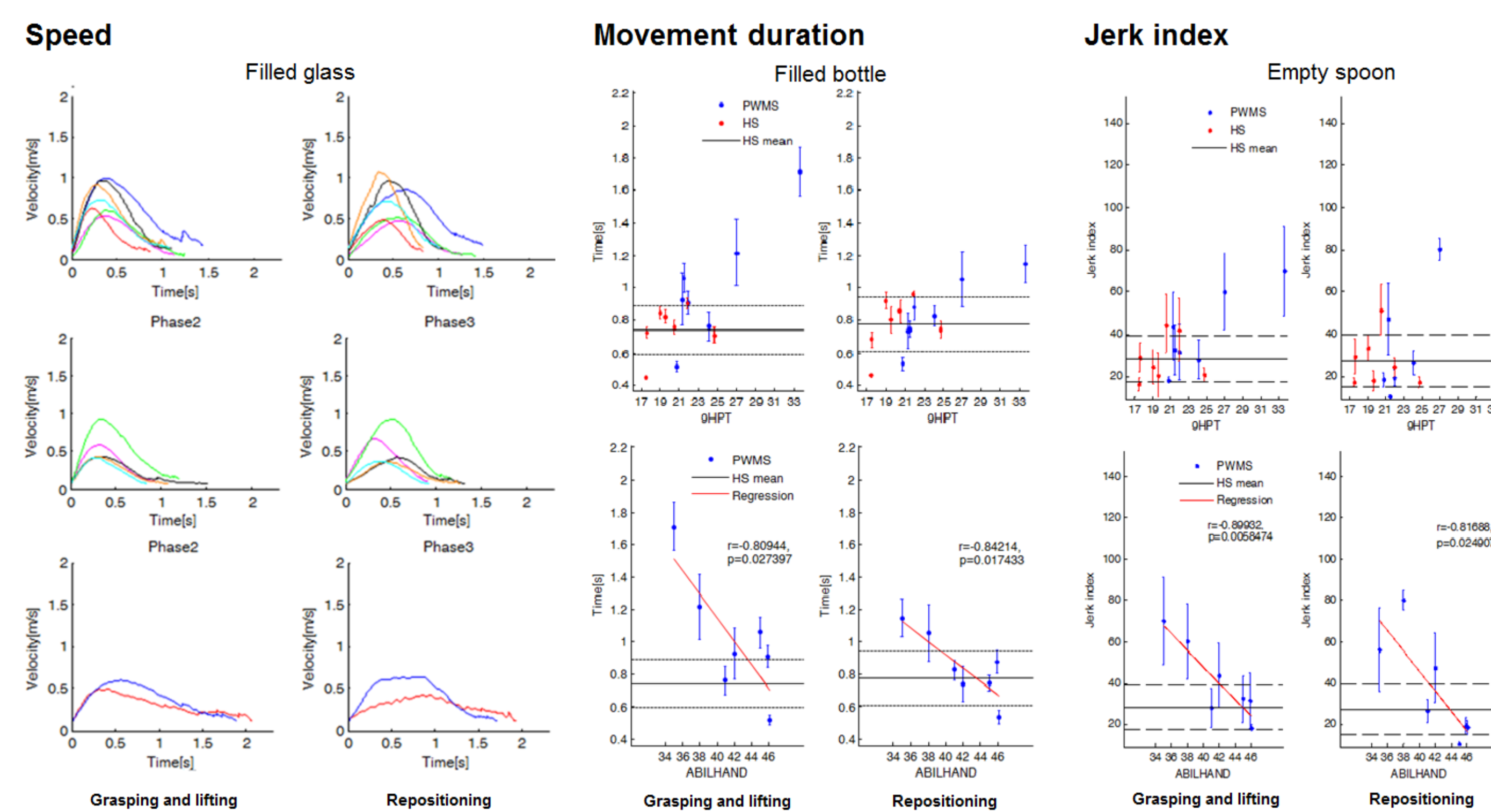
We recruited at Italian Multiple Sclerosis Society (Genoa, Italy) 7 righthanded healthy subjects (HS) (age:  $49 \pm 14$  ys) and 7 righthanded Relapsing-Remitting PwMS (age:  $50 \pm 13$  ys) without relapses in the last three months and absence of neurological signs and symptoms at upper limbs (4 with low impairment,  $EDSS \leq 2$ ; 3 with moderate impairment,  $EDSS > 2$ )

Kinematics was compared with the scores obtained administering ABILHAND and 9HPT.



## RESULTS

The most impaired PwMS significantly reduced movement smoothness with respect to HS and low impaired PwMS and high correlation was found with the self-reported disability degree (ABILHAND). All PwMS showed abnormalities in the muscular functions principally during the object lifting phase.



## CONCLUSIONS

All PwMS showed abnormalities in the muscular functions principally during the object lifting phase. A more extensive analysis of kinematic and electromyography should be performed and results verified on a larger population and other ADL.

[1] Santello M et al. Are movement disorders and sensorimotor injuries pathologic synergies? When normal multi-joint movement synergies become pathologic. *Front Hum Neurosci.* 2015 Jan 6;8:1050.  
[2] Cheunga et al. Muscle synergy patterns as physiological markers of motor cortical damage. *Proc Natl Acad Sci U S A.* 2012 Sep 4;109(36):14652-6.