

# In fully ambulatory RR-MS patients, 3D gait analysis may detect wors parameters of stability compared to HC.

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## Objectives

Aims of our study were to detect changes in gait patterns in fully ambulatory patients with relapsing-remitting Multiple Sclerosis (RR-MS) and to evaluate correlations between motor and cognitive functions using a 3D gait analysis approach.

## Methods

29 RR-MS patients (mean age: 37.3±10 years; BMI: 23.7±3.6 kg/m<sup>2</sup>; EDSS: 2±0.9) and 22 age-BMI matched healthy controls (HC) were enrolled. The gait parameters were recorded with a Stereophotogrammetric Qualysis System (240Hz), after placing forty-one passive markers on the body according to a modified Davis protocol. Cognitive functions were evaluated through the Rao brief repeatable battery (Rao-BRB).

The participants underwent 3D gait analysis in three conditions:

- 1) single-task (walk at self-selected speed);
- 2) motor dual-task (walking while carrying a tray with two glasses filled with water);
- 3) cognitive dual-task (walking while serially subtracting seven digits starting from 100).

For all conditions, kinematic and spatio-temporal parameters (including the coefficients of variability, CV) were calculated. The latter were divided into velocity and stability parameters.

## Results

The RR-MS patients, compared to HC, showed during single-task an impairment of stability parameters including stance time ( $p \leq 0.05$ ), stance time CV ( $p \leq 0.05$ ) and swing time ( $p \leq 0.01$ ). An increased degree of ankle dorsal-flexion was also observed ( $p \leq 0.05$ ). The cognitive dual-task determined an increase of instability (swing time CV,  $p \leq 0.05$ ; double limb support,  $p \leq 0.05$ ; DLS/SLS,  $p \leq 0.01$ ) and kinematic parameters (ankle dorsal-flexion,  $p \leq 0.05$ ; thigh flexion,  $p \leq 0.05$ ). The motor dual-task induced a significant increasing of instability parameters in RR-MS patients (stance time,  $p \leq 0.05$ ; stance time CV,  $p \leq 0.01$ ; swing time CV,  $p \leq 0.05$ ; double limb support and its CV,  $p \leq 0.05$ ). Furthermore, the motor dual-task induced reduction of the knee extension and increased thigh flexion ( $p \leq 0.05$ ). Finally, an inverse correlation between cognitive performances and parameters of stability was observed.

## Conclusions

In fully ambulatory RR-MS patients, 3D gait analysis may detect a worsening in stability parameters compared to HC. The worsening of motor pattern during cognitive or motor dual-tasks and the inverse correlation between cognitive performance and gait stability suggests a role of cognition in affecting gait in RR-MS patients.

The study shows that 3D-Gait Analysis is a useful tool to document very slight motor impairment in patient with RR-MS. This approach might be useful in clinical trials to refine the clinical evaluation.

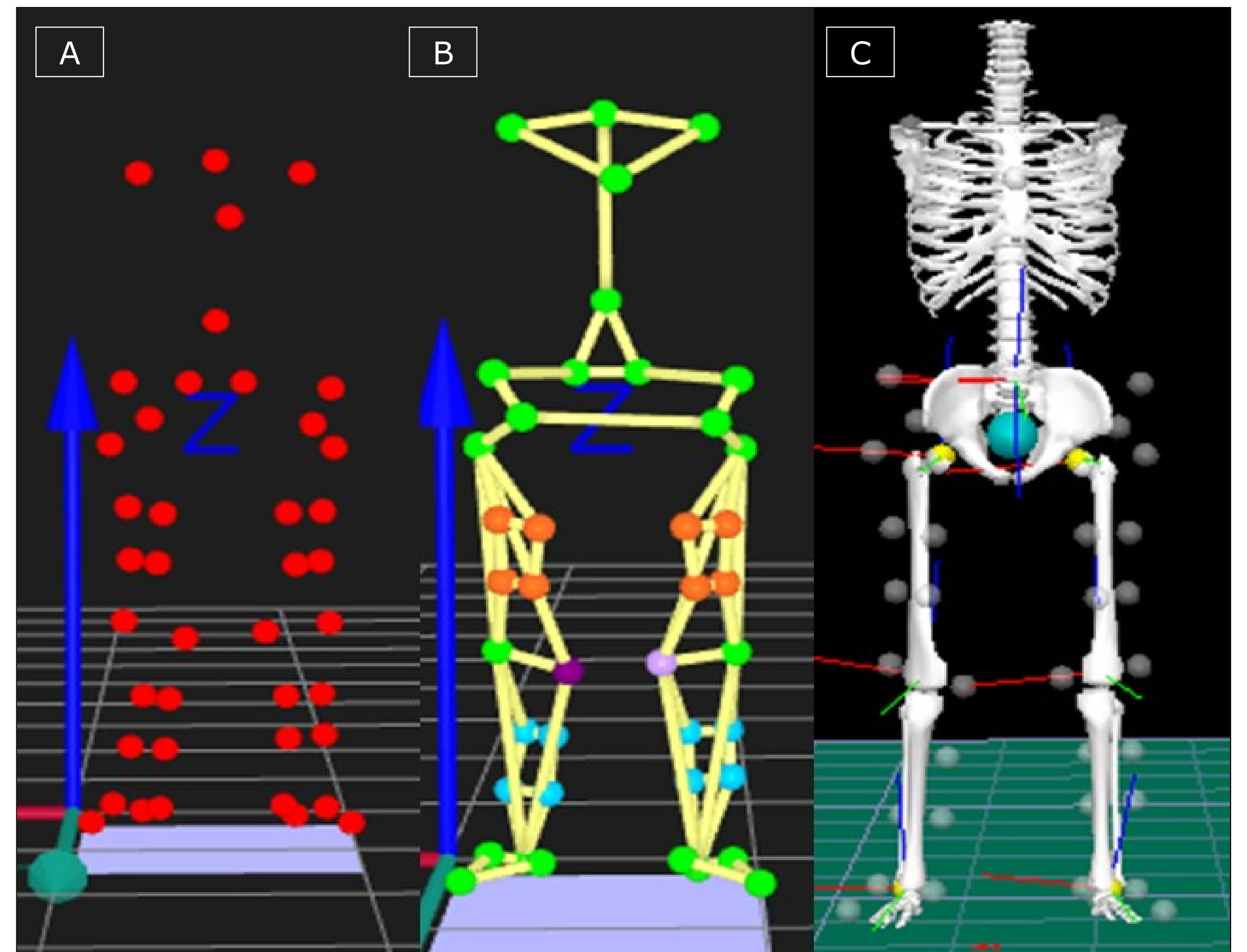


Figure 1 A) Forty-one passive markers; B) Stick figure; C) skeletal model

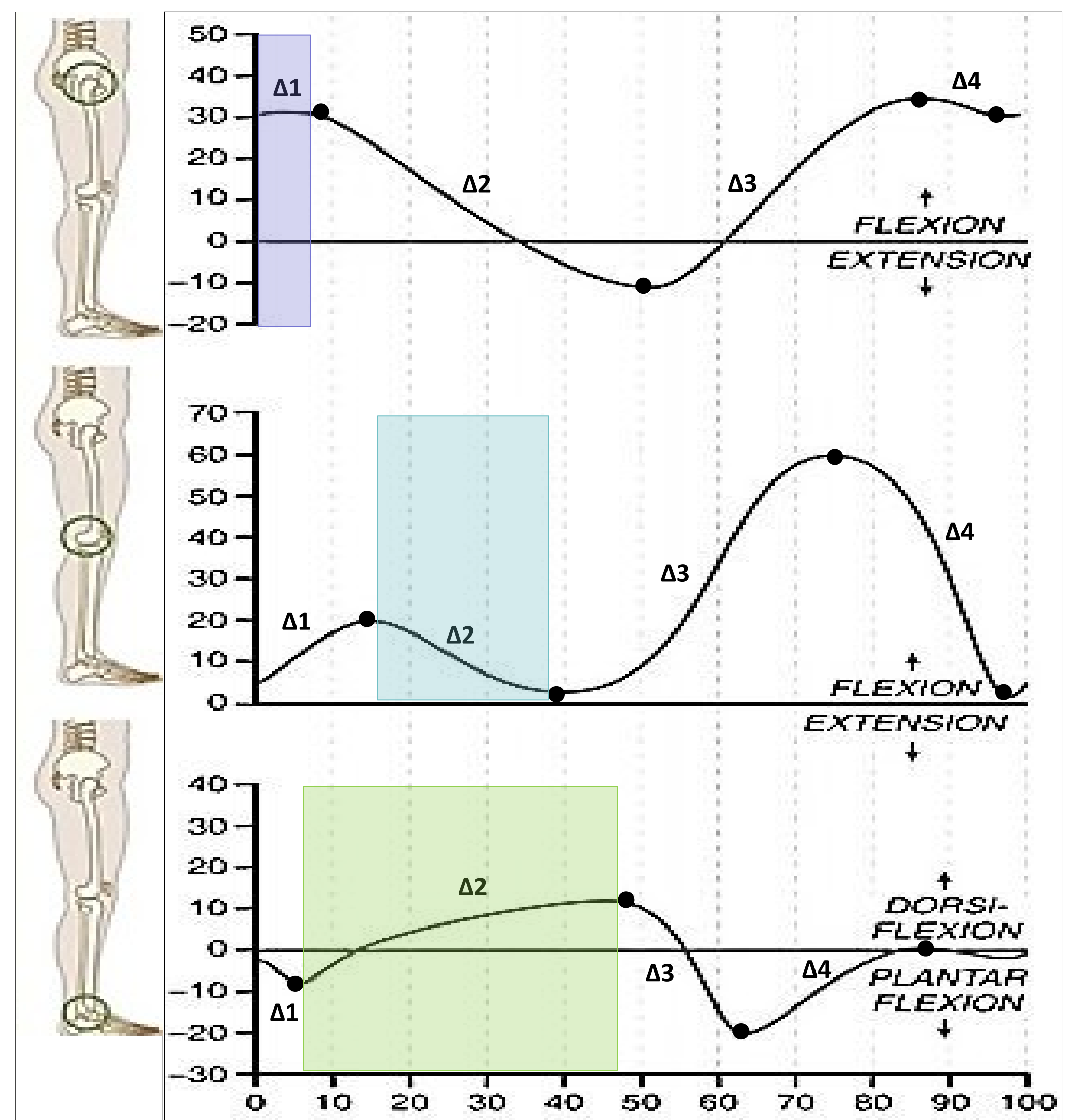


Figure 2 In normal Kinematic curves of ankle, knee and thigh joints, are highlighted the altered phases of gait cycle in RR-MS.

## Bibliography

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