Introduction

- Cervical spondylotic myelopathy (CSM)
  - Showed impaired postural control
- Multiscale entropy (MSE)
  - Measure the dynamics of a control system
  - Quantify the physiological complexity,
  - Adaptability to deal with the environmental challenges.

Purpose

- To examine the changes of dynamical complexity of the postural control system in CSM patients after surgery and post-surgery exercise training.

Materials and Methods

Participants

- 15 CSM patients (10M & 5F, 54.8±10.8 y/o)
  - Exclusion:
    - Spinal surgery
    - Upper neuron disease
    - Tumor
    - Other disease influencing the balance
    - Unable to stand more than one minute independently.
- 5 healthy adults (1 M & 4 F, 23.6±1y/o)

Protocols

- Four stages (the day before surgery, 3, 6, and 12 months after surgery)
- Instruments
  - Force plate (OR6-7, AMTI)
- Parameters
  - Numeric rating scale (NRS), Neck disability index (NDI) and Timed up and go test (TUG)
  - Trajectory of Center of pressure (CoP)
  - Complexity index (CI) of the anterioposterior CoP time series
  - MSE method (data points in vector is 2, tolerance is 0.15, and scale factor is 8)
- Standing tasks
  - Eye open/close on the ground (EOG/ECG)
  - Eye open/close on the foam (EOF/ECF)

Intervention

- Underwent cervical surgery by the same doctor
- Wearing a collar 3 months after the surgery
- Referred to physical therapist for six-week exercise training
- Deep muscles strengthening + Health care

Comparison

- CI
  - Lower in patients than in healthy adults
  - Decrease at 3-month post-surgery
  - Gradually increased till 1-year post-surgery
  - Greater when in more challenged conditions
  - Significant differences: 4 standing conditions except for the pre-surgery state
- CoP trajectory
  - Generally decreased along with the states
  - Healthy group: the lowest

Discussion

- Major findings
  - The control ability to adapt the environmental challenges in CSM patients decreased after surgery, and improved after exercise training (6-month post-surgery) till 1-year follow-up.
  - The CSM patients showed the ability to use different control strategies to adapt the environmental challenges in 3-month, 6-month, and 1-year after surgery.
  - The CSM patients showed the improvement of postural stability after surgery till 1-year follow-up, but still not as good as that in healthy adults.

- Significance
  - The spinal surgery was showed to improve the ability to improve postural dynamics under different standing conditions in the CSM patients.
  - After post-surgery exercise training, complexity of balance dynamics trended to increase and lasted till 1-year follow-up.
  - The results could be the basis for the treatment procedures dealing with the posture control problem of the CSM patients.

References