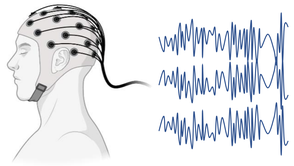
Resting-State Cortical Electroencephalogram Rhythms and Network in Patients after Stroke

Jack Jiaqi Zhang[1], Zhongfei Bai[2], Kenneth NK Fong[1],
[1]Department of Rehabilitation Sciences, The Hong Kong Polytechnic University, Hung Hom, Hong Kong SAR, China
[2]Shanghai YangZhi Rehabilitation Hospital (Shanghai Sunshine Rehabilitation Centre), School of Medicine, Tongji University, Shanghai, China
Corresponding author: Dr. Jack Jiaqi Zhang, Research Assistant Professor, Department of Rehabilitation Sciences
Email: jack-jiaqi.zhang@polyu.edu.hk

The 20th Asia Pacific Multidisciplinary Meeting for Nervous System Diseases
BRAIN 27-28 JANUARY 2024

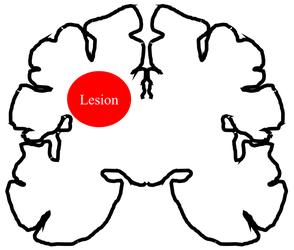
Introduction

- The **neurophysiological pattern of cortical rhythms** can be changed by an acute stroke.
- The ratio of lower-frequency activities to higher-frequency activities determines the degree of physical disability and the recovery potential of upper extremity motor functions in patients with acute stroke.
- However, there is a significant knowledge gap regarding the neurophysiological alterations and potential biomarkers in **patients with chronic stroke**.



The current study aimed to:

- To investigate the resting-state cortical electroencephalogram (EEG) rhythms and networks in patients with chronic stroke.
- To examine their correlation with motor functions of the hemiplegic upper limb.

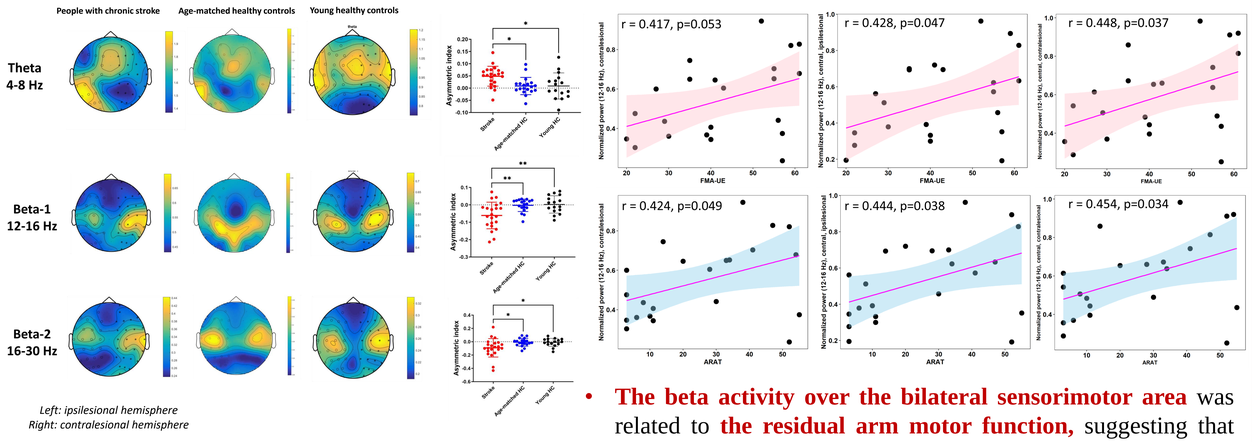


Methods

- Three-minute resting-state EEG data from 22 chronic stroke patients were compared to EEG data from 19 age-matched and 16 younger-age healthy controls.
- The EEG rhythmic powers were computed.
- Three graph theory-based EEG network metrics was calculated:
- (1) **Network strength**, which was calculated as the sum of the edge weights connected to the channels.
- (2) **Clustering coefficient**, which was a measure of **functional segregation**,
- (3) **Global efficiency**, which was a measure of **functional integration**.
- Among patients with stroke, upper limb motor functions were evaluated using **the Fugl–Meyer assessment-upper extremity scores (FMA-UE)** and **action research arm test (ARAT)**.

Results and concluding discussion

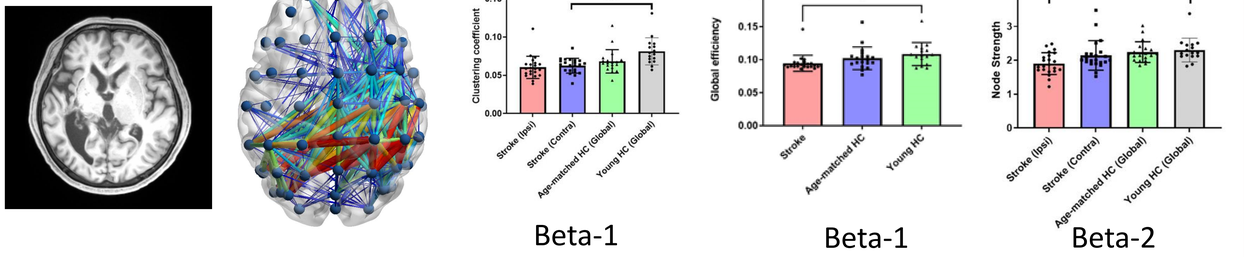
Finding 1: Cortical EEG power spectrum



Left: ipsilesional hemisphere
Right: contralesional hemisphere

- **Hemispheric asymmetry** was observed in the theta and beta bands in patients with stroke, compared with that in healthy controls.
- **The low-frequency oscillation** is likely to be a pathological signature of stroke-related injury.
- **The beta activity over the bilateral sensorimotor area** was related to **the residual arm motor function,** suggesting that the ipsilesional and contralesional sensorimotor areas may contribute to motor functioning in chronic stroke survivors.
- This finding suggests a form of **adaptive neuroplasticity in bilateral sensorimotor oscillations**, where **both hemispheres contribute to the motor functions of the paretic upper limb** in patients with stroke.

Finding 2: Cortical EEG networks



- The hemisphere affected by stroke exhibited **reduced influence** (reduced **network strength** and **global efficiency**) and **functional segregation** (reduced **clustering coefficient**) in the whole-brain network.