Right Hand Motor Control Difference

between Adults with and without Autism

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Background

Recent studies have provided growing evidence of motor differences in individuals with autism (e.g., Bhat, 2023; Miller et al, 2024). Also, atypical brain lateralisation in autism has been extensively documented (e.g., Floris et al., 2021; Li et al., 2023). However, the precise relationship between this atypical brain lateralisation and motor control challenges in autism remains not fully understood.

Additionally, it has been suggested that intentional motor control differences in autism are related to the differences in brainstem function (Trevarthen & Delafield-Butt, 2013; Seif et al., 2021).

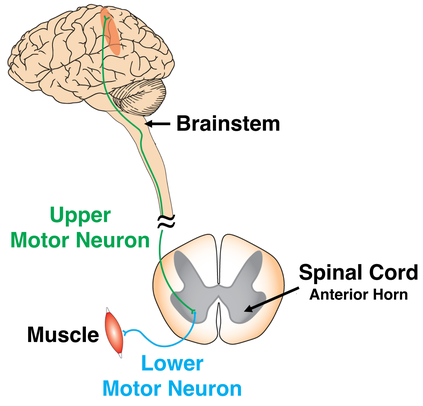
This study aims to investigate motor control differences between individuals on the autism spectrum and those with typical development, in their left and right hands during a postural control task.

Methodology

Participants: A total of 22 adults (age range: 19-57 years) participated in the study, with 9 on the autism spectrum (AS) and 13 exhibiting typical development (TD). All participants were right-handed.

Postural Control Task: Inertial measurement units (IMUs, Blue Trident, Vicon Motion Systems) were attached to the backs of their left and right hands. Participants sat on a chair, held their arms outstretched for 30 seconds (Figure 1), and repeated this task three times with short breaks in between.

Data Analyses: IMU signals were collected at a sampling rate of 1125 Hz, and the magnitude of acceleration was computed. The first and last 2 seconds of data were discarded before the Welch's power spectral density (PSD) estimate was performed. The dominant frequency was identified as peak of the PSD, and the median values of three trials were used to conduct the statistical comparison between the AS and TD groups using Mann-Whitney U test.



Neuromotor circuit figure adapted from
https://www.physio-pedia.com/File:UMN_vs_LMN.png

Figure 1. Participants held their arms outstretched for 30 seconds, with inertial measurement units (IMUs) attached to the back of their hands, testing their motor control.

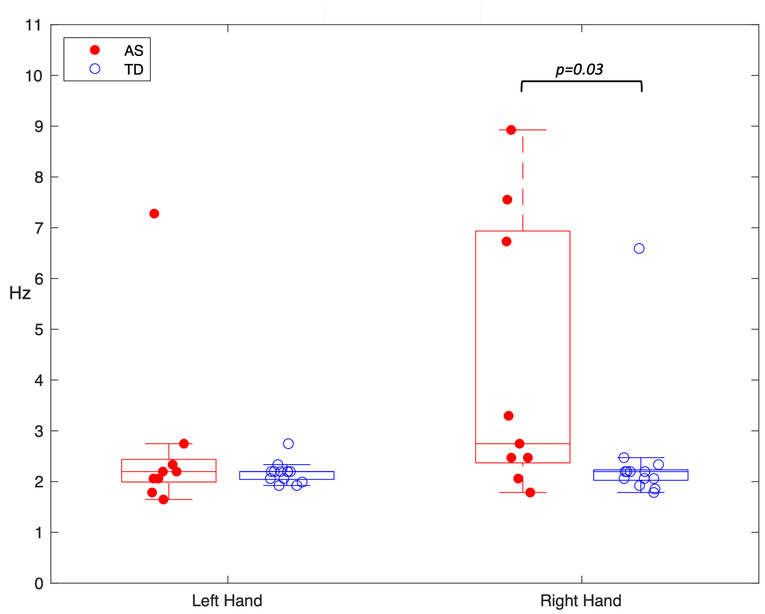


Figure 2. Compared to the typically developing group (TD), the autism group (AS) exhibited a significantly higher dominant frequency in the right hand, but not in the left hand.

Results

Right Hand (Dominant Hand)

Compared to the TD group, the dominant frequency of the right hand was significantly higher in the AS group, with median values of 2.75 Hz versus 2.20 Hz ($p=0.03$).

Left Hand (Non-dominant Hand)

No significant difference between the AS and TD groups was observed in the dominant frequency of the left hand (median values of 2.20 Hz versus 2.20 Hz).

Discussion & Conclusion

The results of this study revealed motor control difference only in the dominant hand (i.e., the right hand). This observation may support the association between motor differences and atypical brain lateralisation in autism (Floris et al., 2016).

Most of the dominant frequency data is located around 2-3 Hz, while some of the autism right-hand data are around 7-9 Hz (Figure 2). This higher dominant frequency might be related to differences in the neural system associated with postural stability control, including the understudied brainstem function in autism (Delafield-Butt & Trevarthen, 2017; Baizer, 2021).

Further research, including brain imaging studies, may help confirm these brain function differences and their impact on motor control. This understanding will inform the development of support to minimize the motor challenges that affect the health and wellbeing of individuals on the autism spectrum.

References

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