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Prefrontal Brain Activity during Robot Assisted Gait Training in Children with Cerebral palsy: a pilot test

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Ⅰ. Objective

➢ Increasing brain activity through rehabilitation therapy has been associated with neuroplasticity and motor learning.

➢ Some studies have attempted to measure brain activity during gait training in children.

➢ This study aims to investigate the feasibility of measuring and utilizing brain activity during robotic assisted gait training for children with cerebral palsy.

Ⅱ. Methods

➢ Brain activity of a child with cerebral palsy undergoing robot(Lokomat pro, Hocoma, Switzerland) assisted gait training was measured using a wireless brain activity measurement device(NIRSIT, OBELAB, Korea).

➢ Changes in brain activity were measured while subjecting the child to two different robotic assisted gait training methods.

	Speed	Body Weight Support	Guidance Force
Easy mode	0.5	80%	100%
Difficult mode	1.0	50%	50%

➢ Brain activity was measured twice in the following order to obtain the mean value.

• Rest (1 minute) – Easy mode (1 min) - Rest (1 min) - Difficult mode (1 min) x 2

Ⅲ. Results

➢ The brain activity of a child with cerebral palsy (female, 15 yr old) was measured during robot assisted gait training.

➢ HbO2 concentrations increased in the prefrontal regions (Left DLPFC, Left VLPFC, and Left OFC) in the child with cerebral palsy under application of the difficult mode of the robot (Table 1).

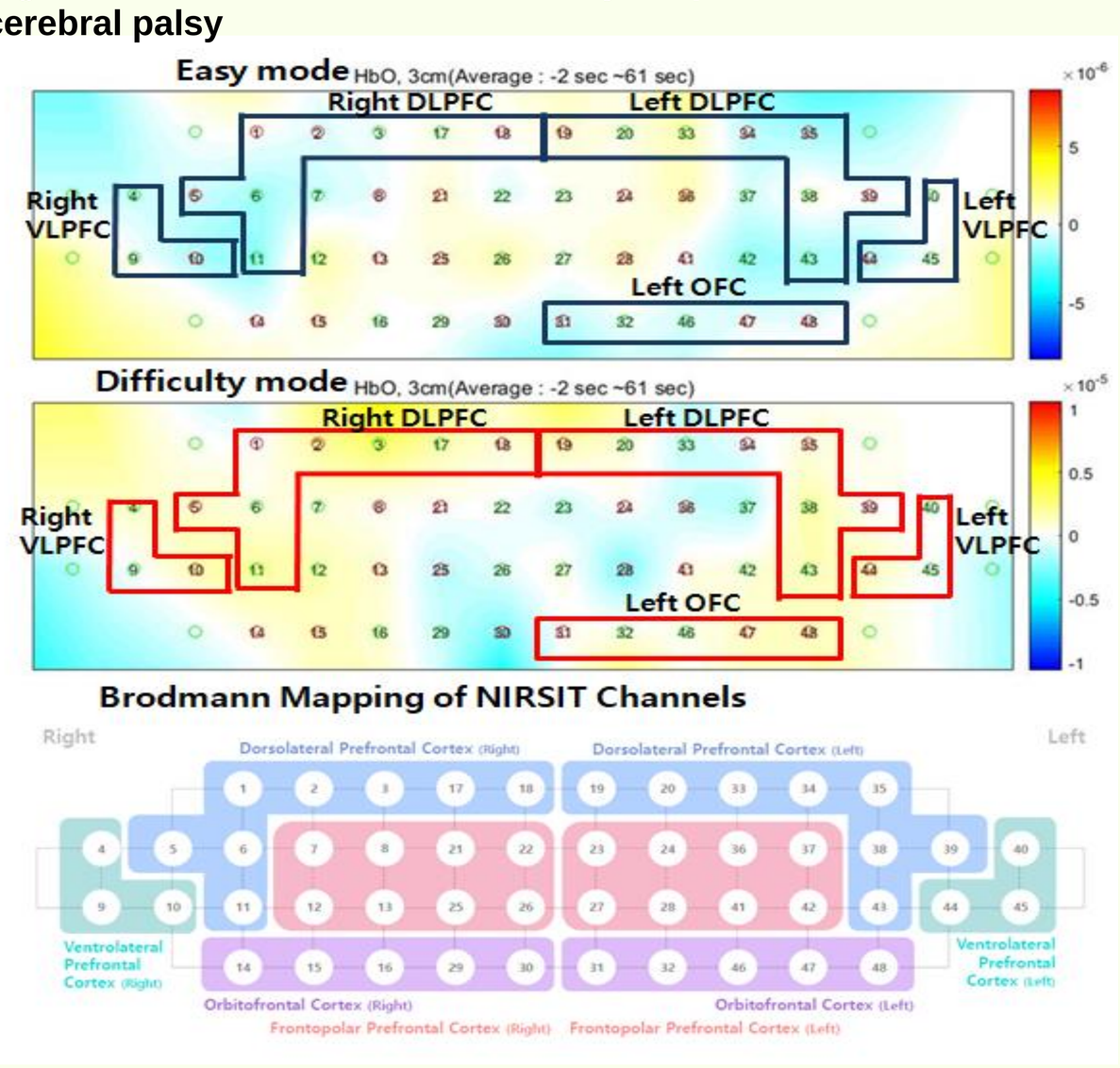
Table 1. Comparison of brain activity(HbO2 concentration) responses by Brodmann area according to training difficulty

Unit: μM(Micromolar)

Brodmann	Easy mode	Difficulty mode	Difference (Difficulty-Easy)
Left DLPFC	-1.03573	-0.679787	**0.355943**
Left VLPFC	0.878729	2.48351	**1.604781**
Right FPC	0.016455	-0.0117283	-0.0281833
Left FPC	0.0000032 1357	-0.582412	-0.582415
Right OFC	0.0665793	-0.677028	-0.7436073
Left OFC	-0.5508	0.671189	**1.221989**

*: As the right DLPFC and right VLPFC regions could not be measured during calibration, it was impossible to analyze the data.

Fig 1. Task A, Task B brain activity response in children with cerebral palsy



➢ The child did not complain of discomfort (pressure) while the fNIRS was placed on her forehead, nor did she have any significant reactions to the device, or experience any other major problems during the study.

Ⅳ. Conclusion

➢ This study demonstrated that it is possible to measure brain activity in children with cerebral palsy during robot assisted gait training. In addition, the prefrontal brain activity of the child varied depending on the training method.

➢ When the child performed a difficult motion, the cognitive load on the frontal lobe may have increased, there by increasing brain activity. This cognitive load is an important factor in the effectiveness of motor learning.

➢ Further research on brain activity during robotic assisted gait training is expected to be conducted to enable appropriate selection of the training mode of the robot and study its therapeutic effects.

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