AID2GAIT - REAL-TIME BIOFEEDBACK FOR MONITORING ROBOTIC ASSISTED GAIT TRAINING IN CHILDREN WITH CEREBRAL PALSY: A PRELIMINARY STUDY

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Background and Aims

Cerebral Palsy (CP) is a non-progressive neurological disorder affecting movement and posture. Robotic Assisted Gait Training (RAGT), using exoskeletons, has shown promising results in promoting motor control and neuroplasticity. Patient engagement, influenced by motivational and psychophysical factors, is crucial for therapy effectiveness. This case study, part of the PRIN 2022 PNRR "AID2GAIT" project, evaluates motivation, neuroplasticity, and physiological parameters in a paediatric patient undergoing RAGT.

Methods

Conducted at the Padre Pio Rehabilitation Centers Foundation (FG), the study involved a paediatric CP patient over 12 RAGT sessions with the pediatric Lokomat® system over 30 days (3 sessions/week). Physiological and kinematic data were collected during sessions T0, T1, and T2. Clinical scales WeeFIM and GMFM-88 were evaluated at T0 and T2. Heart rate variability (HRV) was monitored via Garmin Vivosmart 5® smartwatch, facial temperature via FLIR A400® thermal imager, and brain activity via fNIRS (functional near-infrared spectroscopy), measured by Cortivision® PhotonCap. Wavelet analysis of hip/knee movements estimated active participation.

Results

WeeFIM showed mobility and locomotion improvements; GMFM-88 reported an 11.6% total increase. HRV rose by 7.5%, indicating higher engagement. Facial temperature decreased from T0 to T2 (e.g., nose -2.4%, nostrils -31.2%), except for the perioral area, suggesting reduced fatigue and increased well-being. Wavelet power from exoskeleton data increased by 22.1%, reflecting greater active contribution. fNIRS results indicated increased cortical activity.

Conclusion

RAGT improved both physical condition and engagement in the patient, supporting its potential in paediatric neurorehabilitation. These results highlight the importance of integrating multimodal monitoring tools to personalize therapy in real-time. Further studies will validate this approach in larger populations and explore predictive models for long-term outcomes. This work was supported by the European Union – Next Generation EU, Mission 4, Component 1, CUP D53D23021770001, Project Name: AID2GAIT.

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