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ANKLE PROPULSIVE TORQUE DURING WALKING IN CHILDREN WITHOUT AND WITH BACKPACK LOADING CARRIAGE

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Background: School-aged children often carry significant weight due to the school supplies required for daily activities. This overload can lead to biomechanical, structural, and strength changes, impacting musculoskeletal development and posture.

Objectives: Compare the propulsive ankle torque during walking without load and with 10% of the body mass in children aged 8 to 10 years.

Methods: A cross-sectional study approved by the local ethics committee was conducted with healthy children. Fifteen children (53.3% boys) (9.6 ± 0.5 years; 33.1 ± 4.5 kg; 1.36 ± 0.5 m) participated in the study. Gait analysis was performed at a 5km/h control speed in a biomechanics laboratory equipped with a motion capture system (Vicon, EUA) using reflective markers, specifically the Plug-in-Gait model from Vicon Motion Systems. The system's cameras recognized these markers, and the children were evaluated under two conditions: walking without a backpack and walking with a backpack carrying a load equivalent to 10% of their body weight. Familiarization with the testing area was conducted, and data from seven valid trials were collected for each proposed condition. A trial was considered valid when the child walked a distance of 10 meters and stepped on a force platform. The ankle plantarflexion torque without and with a backpack with 10% were compared using a paired Student's t-test and the effect size was calculated by Hedges' g, with a significance level set at $p < 0.05$, using the Statistical Package for the Social Sciences.

Results: The ankle plantarflexion torque with a backpack with 10% of the body weight was significantly higher (1.2 ± 0.1 N.m/kg) compared to the ankle plantarflexion torque without a backpack (1.1 ± 0.1 N.m/kg) ($p < 0.001$; Hedge's $g = 0.94$, 95% CI = 0.36 to 1.43).

Conclusion: A slight increase in plantarflexion torque was observed when children walked while carrying an additional 10% body weight in a backpack. During prolonged walking, this may lead to increased energy consumption, potentially causing overload and fatigue, even with a relatively small load. This suggests that carrying a backpack with an additional 10% of their body weight may cause muscular overload.

Implications: Children's weight in their daily activities should be kept below 10% of their body weight to prevent high biomechanical loads and muscular overload during gait.

Keywords: Gait, Torque, Child Health

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EMPOWERING MOBILITY: CO-DESIGNING ASSISTIVE SOLUTIONS FOR CHILDREN WITH SEVERE DISABILITIES - A CASE REPORT

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Background: Independent mobility plays a crucial role in child development, contributing to motor, cognitive, and social skills. Children with severe disabilities often face limited mobility opportunities, impacting their ability to explore their environment. The ADAPT project, a university-based community and research initiative, aims to promote independent mobility for children and adolescents with disabilities through low-cost assistive mobility solutions. The project follows the principles of Patient and Public Involvement (PPI), ensuring that families are actively engaged throughout the process. This case report highlights the impact of co-designing a motorized mobility device for twins with severe disabilities, emphasizing the role of PPI in assistive technology development.

Objectives: The primary objective was to analyze the impact of family involvement in the development and implementation of a customized motorized mobility solution for twin brothers with cerebral palsy, visual impairments, and cognitive disabilities (Gross Motor Function Classification System – GMFCS level IV). A secondary objective was to assess the mother's perception of the intervention's effectiveness and feasibility through qualitative feedback.

Methods: This study employed a case report methodology, using a co-design approach that actively involved the children's mother throughout the development process. Initial assessments were conducted to understand the children's functional abilities and specific needs. A commercially available ride-on toy was modified to include accessible controls, postural support, and visual enhancements based on continuous feedback from the mother. Data collection was based on qualitative reports from the mother, obtained through semi-structured interviews conducted at different stages of the intervention. Follow-ups were performed to monitor the device's usability and its integration into the family's daily routine.

Results: The co-design process resulted in a single adapted ride-on vehicle that could be used by both children at different times, addressing logistical challenges for the family. Key modifications included a centrally positioned activation button with LED lighting for enhanced visibility, an ergonomic seating system to provide adequate postural support, and lightweight motorization to facilitate handling. The mother reported increased participation of the children in daily activities, greater motivation to interact with their surroundings, and improved cognitive engagement. Additionally, she highlighted the ease of integrating the device into their routine and its potential role in preparing the children for future use of powered wheelchairs.

Conclusion: This case report reinforces the importance of PPI in assistive technology development. Family involvement throughout the co-design process ensured that the adapted mobility device was functional, accessible, and aligned with the children's needs. Future research should explore long-term benefits, including the impact on motor development and the transition to more advanced assistive mobility devices.

Implications: This study highlights the significance of integrating PPI principles into rehabilitation and assistive technology development. The findings suggest that co-designed, low-cost assistive mobility solutions can enhance the quality of life and autonomy of children with severe disabilities. Additionally, the approach provides valuable insights for healthcare professionals and