Video-Based Markerless Motion Analysis and Specific Identification of Rolling Movement Patterns in Infants

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Abstract

Statement of the Problem: Infant motor development is a critical process in early growth. Rolling over represents the infant's first autonomous movement, facilitating a change in both points of pressure and visual perspective. Current clinical tools primarily utilize qualitative or semi-quantitative scales, lacking objective quantitative assessment. Clinical Practice: Using the representative gross motor milestone of rolling over as the focal point of the study, we collected video footage of the rolling movements of infants aged 3-12 months with normal development. Through video-based markerless motion capture and analysis, we achieved a quantitative assessment of the infant's rolling movements. Utilizing kinematic indicators, we can classify the rotational patterns of the torso during the infant's roll, including axial rotations led by the shoulder girdle, axial rotations driven by the pelvic girdle, and movement patterns initiated by both the shoulder and pelvic girdles simultaneously. This method is also applicable to children with developmental disorders.

Conclusion & Significance: By utilizing characteristic kinematic parameters, we achieved the identification of trunk rotational patterns during the rolling movement. This provides the potential for an objective, quantitative, and automated assessment of an infant's motor proficiency. Consequently, it offers possible biological markers for the early detection and intervention of children with developmental delays or motor developmental disorders.

Recent Publications

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Lu Z, Qu X, **Chang J**, Xu M, et al. Reallocation of time between preschoolers' 24-h movement behaviours and executive functions: A compositional data analysis. J Sports Sci. 2023 Sep 19:1-9.

Chang J H, Yao X Q, Zou H Y, et al. BDNF/PI3K/Akt and Nogo-A/RhoA/ROCK signaling pathways contribute to the neurorestorative effect of Houshiheisan against cerebral ischemia injury in rats[J]. Journal of Ethnopharmacology, 2016, 194:1032-1042.

Lu Y, Hsiang F, **Chang J H**, et al. Houshiheisan and its components promote axon regeneration after ischemic brain injury[J]. Neural Regeneration Research, 2018, 13(7):1195.



Biography

Jiahui Chang is a doctoral student in Pediatrics, currently enrolled at the Chinese Academy of Medical Sciences & Peking Union Medical College in Beijing. She boasts a multidisciplinary educational background, having earned a Bachelor's degree in Traditional Chinese Medicine. During her master's studies, she was dedicated to the foundational theoretical research of traditional Chinese medicine, as well as the pharmacological studies of herbal medicine in the treatment of strokes. Her current research focuses on the developmental physical fitness assessment of children, intelligence assessment, and analysis of infant motor development.

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