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Personalized Mobility Aid Handle Design for Walking Stability in the Elderly

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Abstract

With the global population aging, enhancing the effectiveness of mobility aids to prevent falls has become increasingly critical. Traditional cane handles typically adopt standardized designs, whereas previous studies have indicated that greater finger involvement can activate more relevant muscle groups effectively. Based on this, we hypothesized that increased finger engagement could improve support stability. This study aimed to investigate the impact of 3D-printed customized handles on users' walking performance. Nine participants were recruited, and a within-subject design was employed to compare gait parameters when using standard versus customized handles. Two-dimensional kinematic analysis was conducted using high-speed cameras and Kinovea software, measuring stride length variability and sway displacement. The results showed that the use of customized handles significantly reduced stride length variability and promoted more stable sway displacement. This study confirms that 3D-printed customized handles can effectively enhance walking stability, providing crucial empirical evidence for the personalized design of mobility aids for older adults.

Keywords: 3D Printing, Customized Products, Disability, Assistive Device, Elderly