

Kinematical Analysis of Normal Children in Different Age Groups during Gait

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Abstract : Background—Gait classifying allows clinicians to differentiate gait patterns into clinically important categories that help in clinical decision making. Reliable comparison of gait data between normal and patients requires knowledge of the gait parameters of normal children's specific age group. However, there is still a lack of the gait database for normal children of different ages. Objectives—The aim of this study is to investigate the kinematics of the lower limb joints during gait for normal children in different age groups. Methods—Fifty-three normal children (34 boys, 19 girls) were recruited in this study. All the children were aged between 5 to 16 years old. Age groups were defined as three types: young child aged (5-7), child (8-11), and adolescent (12-16). When a participant agreed to take part in the project, their parents signed a consent form. Vicon® motion capture system was used to collect gait data. Participants were asked to walk at their comfortable speed along a 10-meter walkway. Each participant walked up to 20 trials. Three good trials were analyzed using the Vicon Plug-in-Gait model to obtain parameters of the gait, e.g., walking speed, cadence, stride length, and joint parameters, e.g. joint angle, force, moments, etc. Moreover, each gait cycle was divided into 8 phases. The range of motion (ROM) angle of pelvis, hip, knee, and ankle joints in three planes of both limbs were calculated using an in-house program. Results—The temporal-spatial variables of three age groups of normal children were compared between each other; it was found that there was a significant difference ($p < 0.05$) between the groups. The step length and walking speed were gradually increasing from young child to adolescent, while cadence was gradually decreasing from young child to adolescent group. The mean and standard deviation (SD) of the step length of young child, child and adolescent groups were 0.502 ± 0.067 m, 0.566 ± 0.061 m and 0.672 ± 0.053 m, respectively. The mean and SD of the cadence of the young child, child and adolescent groups were 140.11 ± 15.79 step/min, 129 ± 11.84 step/min, and a 115.96 ± 6.47 step/min, respectively. Moreover, it was observed that there were significant differences in kinematic parameters, either whole gait cycle or each phase. For example, RoM of knee angle in the sagittal plane in whole cycle of young child group is (65.03 ± 0.52 deg) larger than child group (63.47 ± 0.47 deg). Conclusion—Our result showed that there are significant differences between each age group in the gait phases and thus children walking performance changes with ages. Therefore, it is important for the clinician to consider age group when analyzing the patients with lower limb disorders before any clinical treatment.

Keywords : age group, gait analysis, kinematics, normal children

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