

Gait Analysis of 7-10-Year-Old Children to Investigate Correlation between Spastic Gait and Hip Weakness

Syed Arif Kamal¹, M. Khalid Rajput[#] and Samira Sahar Jamil[§]

SF-Growth-and-Imaging Laboratory, the NGDS Pilot Project, Anthromathematics Group, Departments of ¹Mathematics, [#]Physics, ¹Health, Physical Education and Sports Sciences, University of Karachi, Karachi 75270, Pakistan, [§]Research Center for Mathematical Sciences, FUUAST; ¹sakamal@uok.edu.pk

The study of human gait provides clues to gross and fine motor function of child. One gets a pattern, upon videotaping an undressed child walking or running a number of steps (<http://www.ngds-ku.org/Articles/A14.pdf>). This pattern could be analyzed to find out if the child is suffering from any musculoskeletal or neurological disorder. An abnormal gait may become the first indicator of problems involving CNS (Central Nervous System), trunk or lower-limb (<http://www.ngds-ku.org/Presentations/Gait.pdf>). Trunk deformities may include scoliosis, kyphosis, lordosis (at times kypholordosis) or spondylosis. Gait analysis must be located at the first level of a multi-level screening of school-going children as well as job seekers. For job interviews in civilian, military as well as paramilitary occupations, gait is the main feature noticed by the interviewers. Unfortunately, most of our children have not been taught to walk properly, even in the schools run by the Armed Forces of Pakistan (the first author had a chance to monitor children in these schools for a period of 10 years). Since, a child's gait starts developing around 7 years of age, a detailed observation of gait must be an integral part of unclothed physical examination of all children entering class two. One of the factors contributing to this is the heavy weight of the school bags (<http://www.ngds-ku.org/Papers/J22.pdf>) carried on one side. The bipedal locomotion may be modeled from kinesiological as well as biomechanical perspectives (<http://www.ngds-ku.org/Papers/J16.pdf>). The first one focuses on trajectories, whereas the second one deals with agents causing motion — the forces acting on the body. A child's normal gait lies in the sagittal plane (the plane dividing the body into left and right portions). Spastic gait (hips swaying) is in both sagittal and frontal (plane dividing the body into anterior and posterior parts) planes. It may be caused by hip weakness (positive Tredelenburg sign — child asked to lift each foot to a count of 3, the pelvis, corresponding to affected hip, rises when the weight is borne by weaker hip). In this work, the authors investigated correlation of hip weakness with spastic gait. To accomplish this, gait pattern of 7-10-year old boys and girls, studying in a local school, was observed from both front and back. The children were examined, barefoot, completely undressed, wearing only briefs or panties. The child was asked to walk 20 steps (front and back), twice. 2 observers (one on each side) recorded gait pattern as normal or spastic, toes



Right hip weak (Tredelenburg sign positive), left hip normal (Tredelenburg sign negative), observation of gait from front and back

inward or outward. In addition, screening tests for scoliosis were given:

<http://www.ngds-ku.org/Presentations/Decision.pdf>

Positive visual and forward-bending tests, with the child sitting on stool, were indicative of hip weakness, which was confirmed by looking for Tredelenburg sign. The examination was organized as a game, to maintain interest of students. After the examination, the child left (still undressed) to return back to the dressing area, the examiners used this opportunity to carefully check spontaneous gait, when the child was not aware of being scrutinized. In addition to generating clinically useful data, gait may become as indicator of self-esteem (catwalk), identifier of individuals (whose faces were not visible) and predictor of hostile intent (in controlled environment).

Keywords: Spastic gait, hip weakness, sitting posture, forward bending in the sitting position

Conflict of Interest Statement: No potential conflict of interest is identified for this work

Research Ethics: Project initiated after Institutional Review Process and conducted in compliance with ethical and human-right standards in our region.

Web address of this document: <http://www.ngds-ku.org/Presentations/Spastic.pdf>

HTML version: <http://www.ngds-ku.org/pub/confabstB.htm#C121>:

¹Prof. Dr. Syed Arif Kamal (<http://ngds-ku.org/kamal>), PhD (Mathematical Neuroscience), MA, Johns Hopkins, Baltimore, MD, United States, MS, Indiana, Bloomington, IN, United States, Associated Professor in Orthopedic Surgery, Malmö General Hospital, Sweden (1988), Research Associate in Orthopedic Surgery, James Whitecomb Riley Hospital for Children, Indianapolis, IN, United States (1980) and Member, Subject Committee for Physical Education, Health and Sport Sciences, National Testing Service, Islamabad, Pakistan; **Paper Mail:** Professor and Head, Anthromathematics Group (<http://anthromath.uok.edu.pk>), Chairman, Department of Mathematics (<http://math.uok.edu.pk>) and Project Director, the NGDS Pilot Project (<http://ngds.uok.edu.pk>), University of Karachi (<http://www.uok.edu.pk>), Karachi 75270, Pakistan; **Telephones:** +92 21 9926 1300-6 ext. 2380, 2293