Pediatric Dimensions

Commentary

ISSN: 2397-950X

Instrumented classification of patients with early onset ataxia or developmental coordination disorder and healthy control children

Jean-Pierre Lin*, Zeus Tlaltecutli, and Domínguez Vega

Women and Children's Health Institute, Faculty of Life Sciences & Medicine, Kings Health Partners, UK

Commentary

This elegant work on instrumented classification of children with Early Onset Ataxia (EOA) Developmental Coordination Disorder (DCD) and typically developing Control Children (CTRL) using Inertial Measurement Units (IMU) attached to the arm, forearm and index and comparing with the SARA Scale for the Assessment and Rating of Ataxia [1].

The authors meticulously describe the methodological science applied to 60/79 cases who met the criteria for contributing to analysis which found that 90.7% of healthy Controls, 83.9% of EOA and 62.1% of DCD cases were correctly identified using IMU data analysis.

The scientific methodology will be familiar to motion analysis specialists but relatively new to clinicians. Nevertheless, this data is essential for the wider readership to appreciate the conclusions.

The authors found that '***acceleration***' was an important discriminatory variable. This can be understood to obtain every time a limb changes direction as observed in alternating movements[2]. Indeed, since (mass) X (acceleration) = Force, it is when a limb changes direction that the motor system is most challenged and hence in-coordination (an indeed weakness) is observed if present, as in this current study.

The authors also found that the alternating supination action was more discriminatory than the finger nose test (which involves the alternating flexion and extension of the elbow), whereas the 'chasing' of a spot on a computer screen featured 20th in order of importance for identifying ataxia [1].

The reasons for these findings may relate to the inertia of the limb segment being moved and the pattern of movement. In the case of alternating pronation-supination of the wrist, the rotational moment of inertia of the forearm about the long axis is relatively small and these alternating pronation-supination movements correspondingly rapid but also liable to destabilisation in early life when the brain is still actively developing.

By contrast at the same age, elbow flexion and extension movements have to overcome a higher inertial load, are slower but also less easily perturbed by the action.

By this token, to take an extreme example, it is even more difficult to elicit hip joint ataxia with flexion and extension movements of the leg at the hip because the inertia of the whole leg (with the foot attached) is correspondingly enormous.

It is therefore perhaps surprising that the speed of alternating movements at the ankle, metacarpophalangeal and wrist joints in healthy children doubled between ages 3 and 11 years, despite a 32-fold increase in limb-segment inertia produced by the doubling in limb length over the same period [2-4].

Nevertheless, 'physiological ataxia' of our limbs diminishes over the same period, in part with increasing limb inertia as we grow, but also in keeping with cerebral maturation.

Conversely, control of 'physiological ataxia' is a greater burden to typically developing young, small children whose movements might attract the description of appearing 'clumsy'. At this young age, developing physiology comes at the price of a greater voluntary motor output such as 'co-activation' of muscles or 'co-contraction' to overcome perturbations but at the price of making joints actively stiffer and movements jerkier.

Whether we call this 'physiological dystonia' or 'developmental dystonia', it is worth noting that the only way out is through healthy growth and development (if we can get it) [5].

The authors have set their sights on instrumentally discriminating between healthy controls, early onset ataxia and developmental coordination disorder. This is of particular clinical interest because the finding of a relatively poorer discrimination of cases with DCD with the IMU methodology highlights the possibility that DCD is a clinically broader syndrome which indeed overlaps with true ataxia on the one hand or typically developing children on the other.

The authors point out that they had fewer cases of DCD than EOA or CTRL children, despite the relatively higher frequency of cases of DCD (prevalence 50-60/1000) than frequency of EOA (prevalence <1/1000) which may have underpowered the IMU correlates of DCD in this study.

It would be of interest to readers to know from future studies how the IMU data correlates with the International Classification of Function (ICF) skills and what if any changes are observed with longitudinal follow-up? This could help detect the physiological/developmental (as opposed to pathological) EOA and DCD cases and hence 'clean up' the data.

Correspondence to: Jean-Pierre, Women and Children's Health Institute, Faculty of Life Sciences & Medicine, Kings Health Partners, UK, E-mail: jeanpierrelin@me.com

Received: Sep 16, 2021; **Accepted:** Sep 26, 2021; **Published:** Oct 01, 2021

Further longitudinal work on monitoring severity over time ('improved', 'stable', 'worse') and determining changes with intervention must clearly be an important future objective for this IMU methodology.

References

1. Zeus TDV, Dubber D, Sival DA, Maurits NM (2021) Instrumented classification of patients with early onset ataxia or developmental coordination disorder and healthy control children combining information from three upper limb SARA tests. *Eur J Paediatr Neurol* 34: 74-83. [Crossref]
2. Lin J-P, Brown JK, Walsh EG (1996) The maturation of motor dexterity: or why Johnny can't go any faster. *Dev Med Child Neurol* 38: 244. [Crossref]
3. Wright EG (1987) Inertia, resonant frequency, stiffness and kinetic energy of the human forearm. *Quarterly Journal of Experimental Physiology* 72: 161-170. [Crosssref]
4. Lin J-P, Brown JK, Walsh EG (1994) Physiological maturation of muscles in childhood. The *Lancet* 343: 1386. [Crossref]
5. Lin JP, Nardocci N (2016) Recognizing the Common Origins of Dystonia and the Development of Human Movement: A Manifesto of Unmet Needs in Isolated Childhood Dystonias. *Front Neurol* 7: 226. [Crossref]