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ORIGINAL ARTICLE/ARTICLE ORIGINAL

Evaluation of neuromuscular tone phenotypes in children with autism spectrum disorder: An exploratory study

Évaluation du tonus musculaire chez les enfants avec un trouble du spectre de l'autisme : étude exploratoire

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KEYWORDS
Autism spectrum disorder;
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Summary
Objective. — Motor disorders are known in autism spectrum disorder (ASD), but muscle tone assessments are rarely performed. Muscle tone underpins movement. We investigated muscle tone in 34 ASD children using a standardized neuro-developmental battery, which uses the French norms for muscular tone in children.
Methods. — Dangling and extensibility were used to examine passive muscle tone in the upper and lower limbs and the body axis. A comparison between muscles of the right and left sides enabled the determination of tonic laterality.
Results. — We found a disharmonious tonic typology, with a tonic component for the muscles of the trunk and the proximal muscles of the lower limbs and a laxity component for the ankles and the proximal and distal muscles of the upper limbs (wrists and shoulders). No establishment of tonic laterality was found in the upper limbs in 61% of ASD children ($P < 0.001$).

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Conclusion. — The disturbed tonic organization influenced by subcortical structures, such as the cerebellum, may partially explain the motor disorders, and indefinite tonic laterality may also be linked to low hemispheric brain dominance described in autism. This preliminary examination is necessary before any gross motor assessments to understand the nature of movement disorders, explore typologies and highlight possible soft neuro-motor signs.

MOTS CLÉS
Enfants ;
Évaluation neurodéveloppementale standardisée ;
Tonus musculaire ;
Trouble du spectre de l'autisme

Résumé
Objectifs. — Les troubles moteurs sont connus dans le trouble du spectre de l'autisme (TSA), mais l'évaluation du tonus musculaire est rarement réalisée. Pourtant le tonus musculaire sous-tend le mouvement. Nous avons étudié le tonus musculaire chez 34 enfants avec TSA à partir d'une batterie neurodéveloppementale standardisée, qui utilise les normes françaises chez l'enfant pour le tonus musculaire.
Méthodes. — Le ballant et l'extensibilité ont été utilisés pour examiner le tonus musculaire passif au niveau des membres supérieurs et inférieurs puis de l'axe du corps. Une comparaison entre les muscles des côtés droit et gauche a permis la détermination d'une latéralité tonique.
Résultats. — Nous avons trouvé une typologie tonique dysharmonique, avec une composante d'hypertonie au niveau des muscles du tronc et des muscles proximaux des membres inférieurs et une composante d'hyperlaxité pour les chevilles et les muscles proximaux et distal des membres supérieurs (poignets et épaules). Une absence de prédominance tonique au niveau des membres supérieurs a été trouvé chez 61 % des enfants atteints de TSA ($p < 0{,}001$).
Conclusion. — L'organisation tonique perturbée influencée par les structures sous-corticales, comme le cervelet, pourrait expliquer en partie les troubles moteurs décrits dans les TSA, de plus, la latéralité tonique indéterminée pourrait également être liée à une dominance cérébrale hémisphérique absente ou peu dominante décrite dans l'autisme. Cet examen préliminaire est nécessaire avant toute évaluation de la motricité globale pour comprendre la nature des troubles du mouvement, explorer les typologies et mettre en évidence des signes neurologiques doux.

Introduction

Autism spectrum disorder (ASD) is a neurodevelopmental disorder with a multifactorial origin that affects a child's development at an early stage and persists into adulthood. Children are characterized by pervasive impairments in several areas of development associated with restricted patterns of behavior and interests, which affects social functioning and communication. Recent literature indicates movement and coordination disorders and impairment in gross motor skills in autism, but no systematic and standardized approach has been used despite the increased performance of motor assessments [22]. Muscle tone assessment is a difficult examination in children with ASD because it requires physical contact and access to voluntary muscle relaxation. Few studies have reported neurological examination or investigations of walking in people with autism, nor data regarding muscular tone [11,18]. Moreover, tone data are often derived from imprecise muscular tone exploration methodologies without any reference to standards in children. Passive or active muscular tone is not explored in a standardized manner. Shetreak-Klein et al. [29], measured joint angles and found evidence of greater ligament laxity in distal limbs in children with ASD compared to a control group. Hypotonia was also reported in several observational clinical studies. Adrien et al. [1] retrospectively analyzed video of young children later diagnosed with autism and noted a ''passivity'' in these children that was characterized by a lack of initiative, hypoactivity and hypotonia (i.e., low tone and no tonic reactions to stimuli). Ming et al. [18] performed physical examinations of children aged 2 to 18 years and highlighted reduced resistance to passive movement in the limbs. These authors found a high prevalence of mild to moderate hypotonia in approximately 63% of the 2—6-year old children, and the prevalence in 7—18-year olds was only 38%. Another study demonstrated minor neurological dysfunctions using assessments of soft signs with the Touwen examination in children with ASD; this study mentioned dysfunctional muscle tone without specifying the nature or localization of the dysfunction [8]. Other studies used the Physical and Neurological Examination for Soft Signs (PANESS) but provided no information on muscle tone [13,17]. No current studies have specifically examined muscle tone in children with ASD. However, according to Bergès [6], muscle tone is the foundation on which movement emerges and is elaborated. The examination of muscle tone is an essential prerequisite to any examination of motor skills that account for neuromuscular maturation, subject typology (e.g. hyperlaxity and hypertonicity), tonic lateral dominance and possible neurological or neuromuscular disorders. Most studies have assessed gross motor skills in children with ASD using global batteries of movement without developmental references. However, these tools do not elucidate our understanding of the nature of dysfunction,