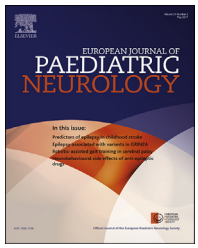
Official Journal of the European Paediatric Neurology Society



Original article

Theory of mind, emotional and social functioning, and motor severity in children and adolescents with dystonic cerebral palsy

Dolapo Adegboye [a,b,*,d], *Annette Sterr* [b], *Jean-Pierre Lin* [a], *Tamsin J. Owen* [a,c,**]

[a] *Complex Motor Disorders Service, Children's Neurosciences, Evelina Children's Hospital, Guy's & St Thomas' NHS Foundation Trust, London, UK*
[b] *University of Surrey, Guildford, UK*
[c] *Royal Holloway, University of London, UK*

ARTICLE INFO

Article history:
Received 26 April 2016
Received in revised form
19 November 2016
Accepted 12 January 2017

Keywords:
Theory of mind
Cerebral palsy
Social difficulties
Emotion regulation

ABSTRACT

Aims: This cross-sectional study aimed to investigate whether children and adolescents with dystonic cerebral palsy (CP) present with emotional and social difficulties along side motor limitations.
Participants/measures: Twenty-two verbal and nonverbal children and adolescents with dystonic CP were compared with a normative sample of twenty children and adolescents on measures of theory of mind (ToM), emotion regulation (ER), and social difficulties (SD).
Results: Higher social and emotional difficulties were found in the dystonic CP group compared to the control group. Nonverbal participants with dystonic CP were found to present with greater social impairment and lower ToM ability than their verbal counterparts. Emotional regulation and hyperactivity and attentional difficulties (HAD) significantly predicted ToM ability and social difficulties. Lower Gross Motor Function Classification System (GMFCS) level and IQ also contributed to differences in ToM ability.
Interpretation: Findings support the need for greater attention to the emotional health and social development of children/adolescents with dystonic CP, along with assessments of motor difficulties in the planning and implementation of interventions and individual care plans. Further research is needed to explore links between motor disorder and mental state understanding in this clinical group.

List of Abbreviations: CP, cerebral palsy; TD, typically developing; V, verbal; NV, nonverbal; ToM, theory of mind; SD, social difficulties; ER, emotion regulation; HAD, hyperactivity and attentional difficulties; IS, impact scale; AAC, Augmentative and Alternative Communication; LD, learning difficulties; MANOVA, Multivariate Analysis of Variance; ANCOVA, Analysis of Covariance.

* *Corresponding author*. Complex Motor Disorders Service, Paediatric Neurosciences, Evelina Children's Hospital, Guy's & St Thomas' NHS Foundation Trust, SE1 7EH, London, UK.
** *Corresponding author*. Complex Motor Disorders Service, Paediatric Neurosciences, Evelina Children's Hospital, Guy's & St Thomas' NHS Foundation Trust, SE1 7EH, London, UK.
E-mail addresses: dolapo.adegboye@kcl.ac.uk (D. Adegboye), tamsin.owen@gstt.nhs.uk (T.J. Owen).
[d] Institute of Psychiatry, Psychology, & Neuroscience, King's College London, UK.

http://dx.doi.org/10.1016/j.ejpn.2017.01.013
1090-3798/

1. Introduction

Cerebral palsy (CP) is an umbrella term for a group of non-progressive motor disorders caused by damage to the immature brain, resulting in abnormal development of movement and posture.[1] Dystonic CP is less well understood than hemiplegic CP or the more widely recognised bilateral spastic CP phenotypes.[2] Dystonia presents specific motor challenges but it is now recognised that non-motor symptoms occur in 95% of adults with dystonia and these are independent of motor severity or dystonia duration.[3] A range of non-motor problems have been identified, including communication difficulties,[4] problems with emotion regulation, theory of mind (ToM) and peer relation difficulties.[5] Damage to speech production regions of the brain, causing dysarthria, often occurs in dystonic CP, resulting in a typical dystonic-athetoid speech pattern due to palatal dystonia with nasal escape and often exacerbated by irregular breathing patterns. Since dysarthria in CP affects 31% and 88% of children,[6] it is essential to assess the role of non-verbal as well as verbal communication in the emotional health of children with dystonia.

1.1. *Emotional functioning*

An increased prevalence of emotional and behavioural difficulties has been reported in children with CP. It has been reported that 32% of children with CP score in the abnormal range for peer relationship problems, and 40% of parents report a significant impact on the family as a result of their child's emotional and behavioural difficulties.[7]

Emotion regulation (ER) is defined as the ability to control and manage emotions using strategies such as monitoring, evaluating, and modifying emotional reactions.[8] Higher levels of ER ability have been linked to successful social interaction with peers.[9] Alongside the peer relationship problems previously reported in children with CP, this suggests a need to assess emotion-regulation ability in children with CP.

1.2. *Social participation*

Children with CP are considered to have a reduced potential for social interaction and engagement with their social environment due to limited motor capacity.[10] Few studies have looked specifically at social competence in children with conditions such as CP, however, explorations of peer relations in a similar population of children with hemiplegia, revealed that this cohort of children were twice as likely as controls to be rejected, have fewer friends, and three times more likely to be victimised.[11] These findings are also echoed by low scores on self-perceived social acceptance found by a study looking at the self-concept of children with ambulant CP.[12]

1.3. *Theory of mind and social difficulties*

Theory of mind (ToM) has been described as the ability to assign mental states to other people and to understand that these mental states influence their behaviour.[13] ToM is considered to be the foundation for understanding the social environment, and it has been argued that a delay or impairment in understanding others' emotions can result in poor social adjustment.[14]

Recent research has suggested that ToM deficits and delays can be found in clinical groups with communication disabilities. For example, one study found that only six out of fourteen non-verbal children with CP were able to successfully solve a first order ToM task.[5] A recent study also showed that syntactic development is related to performance on theory of mind tasks such as the false belief task.[15] This not only suggests that linguistic and communication skills can be important precursors in ToM development, but more importantly, highlights possible non-motor aspects of CP that may be just as important as movement limitations for quality of life. General cognitive ability (measured by Raven's Coloured Progressive Matrices) has also been found to predict ToM performance.[16] Yet, what is not known is whether this extends to social functioning and the possible influence of executive functions such as attention.

1.4. *Communication*

Communicative disabilities can impact children's social and emotional development. Language difficulties can lead to problems with peer relations and leave children vulnerable to victimisation and social exclusion. Some children with CP and communicative disabilities use Augmentative and Alternative Communication (AAC) to express themselves, this includes pictograms and Blissymbols. Research has shown that children with complex communication needs such as CP perform comparably to matched comparison groups on advanced social-emotional ToM measures.

1.5. *The current study*

Children and adolescents with CP may face significant social and emotional challenges, yet research investigating these difficulties is sparse. Increasing current understanding of non-motor difficulties in CP will pave the way for investigating non-motor features of neurological disorders, which may occur alongside main presenting symptoms, or even be primary features. This has important implications for exploring interventions for non-motor symptoms such as difficulties in social interaction and overall emotional well-being.

The current study attempts to address the gap in our understanding of the influence of communication difficulties on ToM and social and emotional development by comparing verbal and non-verbal children/adolescents with predominantly dystonic CP with a normative sample of typically developing children/adolescents to examine whether children/adolescents with dystonic CP and communication difficulties show a greater degree of social and emotional difficulties.

2. Method

The research protocol was approved by the NHS Research Ethics Committee, NHS Research & Development, and the