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Sensory processing disorders in children with cerebral palsy

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ABSTRACT

Objective: To evaluate sensory processing in children with CP using the Sensory Profile questionnaire and to compare results with the ones of children with typical development (TD).
Methods: We assessed sensory processing of 59 TD children and 43 CP children using the Sensory Profile, a standardized parent reporting measure that records children's responses to sensory events in daily life. Mann-Whitney test was used to compare the results of sensory processing evaluation among the groups. Bonferroni correction was applied.
Results: We found differences in sensory processing between groups in 16 out of the 23 categories evaluated in the Sensory Profile.
Conclusion: Our results pointed out to the existence of disturbances in the processing of sensory information in CP. Based on the importance of the sensory integration process for motor function, the presence of such important disturbances draw the attention to the implementation of sensory therapies which improve function in these children.

1. Introduction

The motor disorders in children with cerebral palsy (CP) are often accompanied by disturbances of sensation, perception, cognition, communication and behavior (Bax et al., 2005). Some of the most important determinants of sensory deficits are the white matter lesions, present in 45% of the children with CP (Reid, Dagia, Ditchfield, Carlin & Reddihough, 2013). The destruction of white matter can have secondary effects on the development of cortical and thalamic regions, which are responsible for sensory processing (Tsao, Pannek, Fiori, Boyd & Rose, 2014). Other factors present in CP, such as the neuromuscular deficits, can contribute to these sensory impairments since they restrict the child's level of activity (Dos Santos, Pavão & Rocha, 2011).

Sensory impairments may coexist with motor disabilities in children with CP and may contribute to the motor dysfunction observed in these children (Pavão, Silva, Savelsbergh & Rocha, 2015). The success in the performance of motor tasks depends on the quality of afferent inputs which act providing feedback and guiding motor function in order to correct potential motor mistakes (Dunn & Daniels, 2002; Mulligan, 1995; Papadelis et al., 2014).

Sensory impairments in CP are widely discussed in literature (Bleyenheuft & Gordon, 2013; Cascio, 2010; De Campos, Kukke, Hallet, Alter & Damiano, 2014). The main reported disturbances in this population are deficits in stereognosis (Kingles et al., 2010), tactile discrimination and proprioception (Bleyenheuft & Gordon, 2013). However, there seems to be a lack of studies addressing sensory processing disturbances in CP.

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Sensory processing involves registration and modulation of sensory information, as well as an internal organization of afferent inputs in order to provide adaptive behaviors and success in the performance of tasks (Humphry, 2002). The registration process involves the perception of the sensory stimuli by the central nervous system (CNS). Modulation process is the brain's regulation of neural messages providing the balance between excitation and inhibition based on the available stimuli (Dunn, 1999). An adequate sensory integration of afferent inputs ensures children present an adaptive behavior in tasks of daily routine and meet the demands imposed by the environment. Thus, suitable sensory integration promotes functional performance (Dunn, 1999; White, Mulligan, Merrill & Wright 2007).

Therefore, deficits in sensory processing are believed to affect the way a child behaves, including his or her ability to attend, learn, organize (Dunn & Daniels, 2002), as well as they can affect the children's ability to perform motor and functional tasks achieving adaptive success (Mulligan, 1995; Pavão et al., 2015; White et al., 2007). Thus, the systematic evaluation of sensory processing allows therapists to adapt their intervention improving sensory integration of the inputs constantly received from the environment in order to improve motor performance and adaptive success of children with CP (Schhaf & Miller, 2005).

Some procedures of assessment can be used to identify sensory processing disorders, including child and caregiver interview, formal standardized assessments of sensory processing abilities and clinical observations. Identification of these disorders is generally through observation of behavioral difficulties such as responding to touch aggressively, withdrawing from or failing to respond to sensory input (Ayres, 1989; Dunn 1994, 1997, 1999).

In fact, there is a lack of instruments assessing sensory processing in literature (Pavão et al., 2015). This lack is even greater considering children evaluation. Sensory Profile is one of the most complete available validated checklists that measures integrative sensory processing (Dunn & Daniels, 2002; White et al., 2007). It is a parent reporting measure that records children's responses to sensory events in daily life (Dunn & Brown, 1997).

We selected this instrument for our study because it is psychometrically sound; quick to administer, score, and interpret; and most important because it was designed specifically to measure "children's sensory processing abilities that support or interfere with functional performance" (Dunn, 1999) and allows professionals to use in clinical environment. Although we have used an instrument that relies exclusively on a third-party retrospective report, rather than a direct measure of sensory processing capacity or even a direct observational measure of child behavior, this tool is a validated instrument (Dunn, 1999). In addition, sensory processing is a neurological process that cannot be measured directly, so, caregivers are asked to rate child behaviors believed to be associated with sensory processing (White et al., 2007).Although the Sensory Profile has been used in the literature with children presenting different types of developmental disorders (Mulligan, 1995; Schaaf & Miller, 2005; Tomchek & Dunn, 2007), we did not find studies that have used this instrument to evaluate and characterize sensory processing in children with CP.

Taking into account the reported sensory deficits in CP (Kulak, Sobaniec, Kuzia & Bockowski, 2006; Pavão et al., 2015) and their potential repercussions on activity level and social participation (Dunn & Daniels, 2002; Pavão et al., 2015; White et al., 2007), it seems to be important the implementation of a proper evaluation of sensory processing in these children.

Therefore, the objective of this study was to evaluate sensory processing in children with CP using the Sensory Profile and to compare the results with the ones of children with typical development in order to outline the sensory processing impairments observed in CP. We expect that children with CP exhibit a large amount sensory processing disorders compared with typical ones, which can constrain their daily life activities.

2. Methods

2.1. Participants

All the participants were recruited from kindergarten, regular schools or rehabilitation centers specialized in children care. Only participate in the study children who received parental consent to participate. This study was approved by the local Ethics Committee (CAAE 17495213.8.0000.5504).

Two groups of participants were evaluated. The control group was composed by 59 children, 31 male and 28 female, aged from 3 to 15 years-old (M = 8.9 ±3.4 years). Participants with orthopedic conditions which limited physical activity or diagnosed developmental alterations were excluded from the study.

The experimental group consisted of 43 children with spastic CP, 26 male and 17 female, aged between 3 and 15 years-old (M = 9.09 ± 3.4). All the participants were classified by the Gross Motor Function Classification System (GMFCS) as level I (19 children), level II (10 children), level III (seven children), level IV (three children) and level V (three children). GMFCS represents a functional classification of children with CP, which aims to determine the level of the child based on their abilities and limitations to perform gross motor function activities. Children can be classified according with five levels as follows: level I represents the ability to walk without limitations, level II indicates the ability to walk with limitations, level III is consisted of children that walk using a handheld mobility device; level IV includes children that present self-mobility with limitations, and level V is composed by children that are transported in a manual wheelchair (Palisano, Rosenbaum, Bartlett, & Livingston, 2008). We did include neither children who were not regularly inserted in rehabilitation programs at last twice a week nor children with other comorbidities besides CP.