



Review article

Evaluation and characterization of manual reaching in children with cerebral palsy: A systematic review



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ABSTRACT

Manual reaching is used daily to perform manipulative tasks and activities of daily routine. Children with cerebral palsy (CP) have limitations in this activity, with functional loss as a possible consequence. This review aimed to gather studies that evaluated and characterized manual reaching in children with CP, with the purpose of identifying the aspects analyzed, as well as review and discuss the results in the studies and its relationship to the children's level of functionality. 17 studies were selected for this systematic review from the search in electronic databases. The studies showed that children with CP show deficits in several spatio-temporal variables of reaching compared to typical children, such as longer time to perform the activity, higher peak velocity, lower index of curvature, and greater number of units of motion, which indicates lower smoothness and linearity of the movements of upper limbs. The performance is influenced by the level of motor impairment and various manipulations of the task. However, more studies are needed that help translating these results into treatment strategies that facilitate the performance of manual activities in children with CP.

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1. Introduction

Cerebral palsy (CP) is described as a non-progressive injury that occurs in the brain during fetal or infant development, leading to a group of disorders in the movement and posture (Rosembaum, Paneth, Levinton, Goldstein, & Bax, 2007; Rosenbaum, Bax, Goldstein, & Paneth, 2005).

Movements in children with CP lack coordination and harmony due to changes such as spasticity, coactivation of agonist–antagonist muscles, muscle weakness, sensory disturbances and limitations in range of motion (Brogren, Hadders-Algra, & Forssberg, 1998; Woollacott et al., 1998).

One activity limitation in children with CP involves the performance of manual reaching (Van der Heide et al., 2004), which is essential to the development of manipulative activities and daily routine activities (de Campos, Savelsbergh, & Rocha, 2012; Savelsberg, Von Hofsten, & Jonsson, 1997). Studies have found that reaching movements in children with CP present spatiotemporal changes (Ju, You, & Chergn, 2010). Other studies have confirmed electromyographic alterations (Bigongiari et al., 2011), and postural control deficits (Ju, Hwang, & Chergn, 2012). These changes are likely to contribute to difficulties in accomplishing activities such as feeding, dressing, writing, and playing with other children, thus leading to reduced participation in social contexts (Eliasson et al., 2006). Abnormalities in reaching are observed particularly when constraints imposed by the task require children to adjust their activities.

In children with CP during reaching movements, changes in body postures (Hadders-Algra et al., 2007; Hadders-Algra, Fits, Stremmelar, & Touwen, 1999), variations in object properties (Chang, Wu, Wu, & Su, 2005) and in object positioning (Ju et al., 2010) are examples of constraints tested. Given the relevance of task constraints to the performance, it is necessary to assess reaching in children with CP to identify specific factors affecting performance and determine intervention strategies. Although review studies on manual reaching were found in at-risk infants (de Campos, Rocha, & Savelsbergh, 2009) and in children with hemiplegic CP (Jaspers et al., 2009), no systematic reviews were found on manual reaching in children with other types of CP and on the role of different topographical and functional classifications of CP in reaching performance. Accordingly, the objective of the present systematic review is to gather studies that measured manual reaching in children with CP to identify the variables that they assessed, and to review and discuss their findings. The main questions of the study are: Which methods have been used to evaluate manual reaching in CP? Under which task constraints has reaching been evaluated? What are the characteristics of manual reaching in children with CP according to their functional level? What is the methodological quality of the studies reviewed?

2. Materials and methods

2.1. Identification and selection of studies

A literature search was performed from the earliest date of publication referring to the subject of interest up to May 2013, using the following databases: PubMed, Science Direct, SciELO, Medline, ERIC, Wiley Online Library, and Web of Science. The search strategy used the following keywords in English and Portuguese, mapped from the Medical Subjects Headings (MeSH), to filter the search: “reaching” and “children” in combination with the term “cerebral palsy.” Other studies were retrieved from the references list of the selected articles.

The inclusion criteria were applied to the article’s title; subsequently, the abstracts and full texts were read for all articles. If the article did not fit the inclusion criteria, it was excluded from the review.

2.2. Inclusion criteria

Inclusion criteria consisted of (1) evaluation of reaching in children with CP and (2) participants’ age ranging from 0 to 18 years.

2.3. Exclusion criteria

Exclusion criteria consisted of (1) the efficacy of intervention was assessed; (2) reaching was used only as a functional activity and movement of the upper limbs was not specifically evaluated; (3) review studies and (4) populations with various neurologic disorders that were undefined or not related to CP were excluded. In accordance with Cochrane’s

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