

Upper limb function evaluation scales for individuals with cerebral palsy: a systematic review

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Abstract. [Purpose] The aim of the present study was to perform a systematic review of the literature on the scales and methods most often used for the evaluation of upper limb function in individuals with cerebral palsy. [Materials and Methods] Searches were conducted in the Medline, PEDro, Lilacs, Scielo, and PubMed databases. The following inclusion criteria were used for the selection of articles: randomized controlled study, evaluation of upper limb function in individuals with cerebral palsy, and publication between 2006 and 2014. The methodological quality of the articles was evaluated using the PEDro evidence scale. [Results] Five articles met the inclusion criteria and achieved 6 points or higher on the PEDro scale of methodological quality. [Conclusion] The studies analyzed used different evaluation scales, but no consensus has been reached thus far on which scale is the most appropriate. Thus, further studies are needed to establish an adequate method for the evaluation of upper limb function in individuals with cerebral palsy.

Key words: Cerebral palsy, Scale function, Upper limbs

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INTRODUCTION

Cerebral palsy (CP) describes set of permanent, mutable, motor development disorders that originate from a primary brain lesion and cause secondary musculoskeletal problems and limitations with regard to activities of daily living¹⁾. Despite the consensus regarding the occurrence of sensory, motor, and functional impairments in children with CP^{2, 3)}, various methods have been used in the evaluation of these aspects⁴⁾.

Upper limb impairment occurs in 50% to 70% of individuals with CP^{5, 6)}. Spasticity, muscle weakness, and insufficient motor control can give rise to secondary musculoskeletal complications, such as contractures and deformities, which result in limited movements⁷⁾. Thus, the identification of factors that lead to functional impairment is of fundamental importance to clinical decision making and the evaluation of the effects of therapeutic strategies⁴⁾.

A study by Bae et al.⁸⁾ showed that as the tissue compliance of spastic muscles at relaxation increases, muscle tone decreases and muscle activity increases, and spasticity leads to a lower moment-angle⁹⁾. A number of treatments performed in either the home or school setting are proposed

to improve function¹⁰⁾. However, the effectiveness of such therapies depends on well-conducted functional evaluation and patient fitness^{11, 12)}. Methods and tools developed for the evaluation of function have been used in individuals with CP, such as the House Scale¹³⁾, the Pediatric Evaluation of Disability Inventory¹⁴⁾, the Melbourne Assessment¹⁵⁾, the Pediatric Outcome D Collection Instrument¹⁶⁾, the Assisting Hand Assessment¹⁷⁾, ABILHAND-Kids¹⁸⁾, and the Shriners Hospital for Children Upper Extremity Evaluation¹⁹⁾. While some of these measures have been validated, no consensus has been reached as to the best evaluation method for identifying improvements in upper limb function in individuals with CP²⁰⁾. Yu et al.²¹⁾ believes that detailed and diverse investigations should be performed by considering the number and characteristics of subjects.

The aim of the present study was to perform a systematic review of the literature on the scales and methods most often used for the evaluation of upper limb function in individuals with CP.

MATERIALS AND METHODS

Searches were conducted in the Medline, PEDro, Lilacs, Scielo, and PubMed databases using combinations of the following key words: “cerebral palsy,” “upper limb/extremity,” and “functional scales.” The articles retrieved were evaluated independently by two researchers. The following inclusion criteria were used for the selection of articles: randomized controlled study, evaluation of upper limb function in individuals with CP, and publication between 2006 and 2014.

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The methodological quality of the articles was evaluated using the Physiotherapy Evidence Database (PEDro) scale. The PEDro scale has 11 items, each of which receives a score of either 0 or 1, except item 1, which is not scored. The final score ranges from 0 to 10 points. This scale is used to evaluate the methodological quality of randomized, controlled, clinical trials with regard to two important factors as follows: whether the study has internal validity (whether the results offer sufficient information), and whether the study has both clinical and statistical relevance for a clear interpretation of the results and reproduction by other researchers. Any divergence in opinion between the two researchers was discussed until a consensus was reached on the score of the study in question.

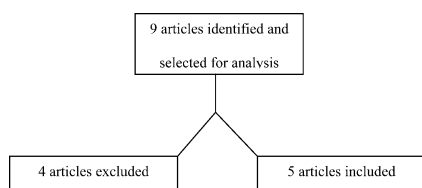


Fig. 1. Flowchart of the studies included in the literature review

Table 1. Articles included in the literature review

Article	Author and year of publication	PEDro	Type of Study
1	Koman et al., 2013 ²²⁾	7/10	Clinical trial
2	Fedrizzi et al., 2013 ²³⁾	9/10	Clinical trial
3	Xu et al., 2012 ²⁴⁾	8/10	Clinical trial
4	Lin et al., 2011 ²⁵⁾	7/10	Clinical trial
5	Redman et al., 2008 ²⁶⁾	6/10	Clinical trial

RESULTS

The database search resulted in the retrieval of nine articles, four of which failed to meet the inclusion criteria (Fig. 1). The five articles included in the present review had PEDro scores of 6 to 9 points (demonstrating methodological adequacy) and addressed the use of upper limb evaluation measures for individuals with CP (Tables 1 and 2). The five studies involved 296 male and female individuals aged 2 to 18 years who were diagnosed with CP. All of the studies used one or more measures to evaluate upper limb function. Table 3 displays the general characteristics (sample size, sample characteristics, and methods) and outcomes of the studies analyzed.

DISCUSSION

Among the upper limb function evaluation measures available in the literature, few are specific to individuals

Table 2. Scores of the articles included in the literature review

PEDro	1	2	3	4	5
Eligibility	N	Y	Y	Y	Y
Randomized allocation	Y	Y	Y	Y	Y
Confidential allocation	Y	Y	Y	Y	Y
Similar prognosis	N	Y	Y	N	Y
Blinded subjects	Y	Y	N	N	N
Blinded therapists	N	N	N	N	N
Blinded evaluators	Y	Y	Y	Y	N
Key results	Y	Y	Y	Y	N
Comparison between groups	Y	Y	Y	Y	Y
Precision and variability	Y	Y	Y	Y	Y
Score	7/10	9/10	8/10	7/10	6/10

Y: yes; N: no

Table 3. Characteristics of the studies included in the literature review

Article	No. of subjects	Characteristics of sample	Methods	Outcomes
1	71	Spastic hemiparesis	EG: 36- Botulinum toxin CG: 35- Placebo injection	The EG achieved a better wrist extension result in the Melbourne Assessment of Unilateral Upper Limb Function than the CG.
2	105	Spastic hemiparesis	EG1: 34- Intensive two-hand training EG2: 33- Modified CIT CG: 33- Standard treatment	The modified CIT group achieved better movement quality in the QUEST than in the other groups and exhibited better quality of life, as measured by the Besta scale.
3	75	Spastic hemiparesis	EG1: 25- CIT EG2: 24- CIT + electrical stimulation CG: 26- Occupational therapy	Among all the groups, EG2 demonstrated the best results for the upper extremity functional test and grasping subtest of the Peabody developmental motor scales.
4	22	Spastic hemiparesis	EG: 11- CIT CG: 11- Control intervention	The EG achieved better results in the PMDS-2, BOTMP, and PMAL than in the CG.
5	23	Spastic hemiparesis	EG: 12- Botulinum toxin CG: 11- Placebo injection	No statistically significant differences were found between the groups. Intraclass concordance was found for daily activities, speaking, and communication on the Pediatric Quality of Life Inventory.

EG: experimental group; CG: control group; CIT: constraint-induced therapy; QUEST: Quality Upper Extremity Skill Test; PMDS-2: Peabody Motor Developmental Scales II; BOTMP: Bruininks-Oseretsky Test of Motor Proficiency; PMAL: Pediatric Motor Activity Log

with CP, as most scales are standardized for use on adult stroke survivors. Despite the similarities between the two types of brain lesions, specificity is needed for the evaluation and treatment of these groups of patients. The articles analyzed in the present systematic review demonstrate the scarcity of studies on upper limb function in individuals with CP, especially with regard to evaluation measures.

According to Koman et al.²²⁾, the Melbourne Assessment of Unilateral Upper Limb Function scale provides objective measures of upper limb function, allows the assessment of the quality of upper limb movements, and demonstrates moderate to high consistency as an evaluation method. Therefore, this scale is widely used by occupational therapists in clinical practice.

All of the studies analyzed emphasized the evaluation of upper limb function associated with a functional therapeutic method or neurolytic block. Fedrizzi et al.²³⁾ applied the Quality Upper Extremity Skill Test (QUEST) and the Besta Scale, which demonstrated good performance and applicability. The QUEST allows an assessment of the quality of one- and two-hand movements in individuals with CP but does not allow an assessment of quality of life. The Besta Scale is used for the assessment of quality of life, as well as functional capacity and movement performance. Thus, the two scales complement one another in the evaluation of function.

Xu et al.²⁴⁾ used the Upper Extremity Functional Test to assess function, dexterity, and movement efficiency, and the Grasping Subtest of Peabody Developmental Motor Scales, which is also known as the Peabody Developmental Motor Scales 2 or PDMS 2, for the two-hand evaluation. In the literature, the PDMS-2 is used less than the Upper Extremity Functional Test. However, the authors do not state whether one of the two scales is more applicable than the other.

Lin et al.²⁵⁾ also used the PDMS-2 and the Bruininks-Oseretsky Test of Motor Proficiency (BOTMP) for the assessment of range of motion and the Pediatric Motor Activity Log (PMAL) to quantify functional capacity, along with the Caregiver Functional Use Survey for the evaluation of caregivers. Improvements in unilateral and bilateral skills were demonstrated by the PMAL, but not the BOTMP. However, positive results were also demonstrated with use of the PDMS-2. The study reports the use of scales that allows the evaluation of functional capacity in children with CP but does not suggest that any particular scale is more favorable in clinical practice due to its greater applicability or the greater reliability of its results.

Redman et al.²⁶⁾ analyzed the use of the Pediatric Quality of Life (PedsQL) scale. Although the authors demonstrated the applicability of this scale for individuals with CP, the PedsQL is not sufficiently sensitive for the detection of small but clinically important changes and has no subscales for the evaluation of upper limb function.

Few studies have addressed the use of assessment measures for upper limb function in individuals with CP. The studies analyzed in the present systematic review used different measures, and no consensus has been reached on the most appropriate scale or which has ideal clinical applicability in this population. Therefore, further studies on this issue are needed to allow the evaluation of upper limb function

in individuals with CP by using well-defined methods that provide reliable information.

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