ORIGINAL ARTICLE

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CRITICAL ANALYSIS OF VARIOUS HAND FUNCTION TOOLS CHILDREN WITH CEREBRAL PALSY

Diksha Joshi.[1], Dr. Chetana A.Kunde[2], Dr.Suvarna S. Ganvir.(PhD)[3]
1. Intern, 2. Assistant Professor 3. Professor & HOD, Department of Neurosciences
, DVVPF,COPT,Ahmednagar

ABSTRACT:

Background: Need for the study is to facilitate the selection and use of assessment tools in daily clinical practice and encourage the development of new and improved outcome instruments for the UE in children with CP that may further be useful in treatment purpose. **Methodology:** Articles on hand assessment measures in children with cerebral palsy were selected from an online electronic database. All the articles were reviewed and compared the basis of their reliability, time required, characteristics of the measure. **Results:** , SHUEE and Melbourne hand assessment scale has greater reliability and appropriate characteristics of measures compared to other scales. But these measures are time consuming and costly. **Conclusion: -** QUEST, SHUEE and Melbourne hand assessment scale proved to be better reliability and appropriate characteristics of measures compared to other scales.

Keywords: Cerebral palsy, Hand function measures, components, time, reliability, unimanual/ bimanual.

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CORRESPONDING AUTHOR

Miss Diksha Joshi

DVVPF'S College of Physiotherapy, Ahmednagar. 414111

E-mail: joshidiksha67@gmail.com

Phone No: +91 9028380113

INTRODUCTION

Hand function is of great importance in the many daily activities that require well-coordinated hand and arm movements. Measurement of hand function is an essential element in the rehabilitation process, in order to facilitate medical diagnosis and determine developmental stages, functional levels, and the efficacy of treatment interventions.

Brain lesions may disturb hand functioning in children with cerebral palsy (CP), making it difficult or even impossible for them to perform several manual activities. There is the affection in tone, strength, the movement pattern of hand, causing difficulty in performing activities of daily living like holding and releasing objects, reach out to a specific target, daily chores such as grooming, eating etc.

Clinical examination is the key to successful treatment. Unlike many other conditions, there is no standard clinical picture for spastic upper limbs, whatever their cause, as the condition primarily depends on the extent of the brain damage, which can vary greatly. A careful assessment of all parameters is therefore mandatory to get an accurate clinical picture of the deficits and potentials in each patient and to treat them accordingly. Parameters such as spasticity, motor and sensory deficit in the upper limb, the posture of limb, existing function and functional needs of the upper limb are important factors to be assessed. The tests and procedures used to evaluate the sensory and motor capacities of the hand are reviewed in the context of normative studies that provide evidence of their reliability and validity. Three broad areas of assessment are distinguished, ranging from the measurement of strength and joint motion to the evaluation of the functional capacity of the hand. The strengths and limitations of the techniques used to evaluate hand function are examined, and the importance of considering a number of variables (e.g., hand preference, age) when interpreting test results from patients is discussed.[1]

NEED FOR THE STUDY-To enhances a therapist's ability to select and use these tools in daily clinical practice for both clinical decision-making and assessment of outcome. To facilitate the selection and use of assessment tools in daily clinical practice, promote the critical assessment of study design and encourage the development of new and improved outcome instruments for the UE in children with CP.

It may further be useful in treatment purpose, as it will focus on specific aspects or components of hand function that is affected.

METHODOLOGY

SEARCH STRATERGY-

Articles published on online electronic data base were included. The search strategy used was medical subject terms and text words for cerebral palsy. Further key words to review articles used were cerebral palsy (diplegic, quadriplegic, dyskinetic, and ataxic CP), hand function, assessment tools and functional scales. Observational studies, randomized control trial, experimental/interventional studies were included. Subsequently, the names of the outcome measures identified through the first search were used in a complementary search, which aimed to identify additional studies of the measurement properties of the hand function measures. Furthermore, references in the included articles and reviews were checked. Papers assessing the measurement properties of the hand function instruments were included for quality analysis.

SELECTION CRITERIA-

Articles included were the (a) Articles considering hand impairment measures used only in children with cerebral palsy. (b) Measures that have been considered valid or reliable upper extremity hand function measures in children with cerebral palsy. (c) Articles reviewed only from an online electronic database site. (d) Articles using observational studies, interventional studies and systemic reviews. (e) Articles published in the English language only. The exclusion criteria were Articles considering hand impairment measures used subjects other than children with cerebral palsy. Measures that are not valid, reliable or published upper extremity hand function measures in children with cerebral palsy. Articles published in a language other than the English language.

SELECTION OF STUDIES AND DATA EXTRACTION

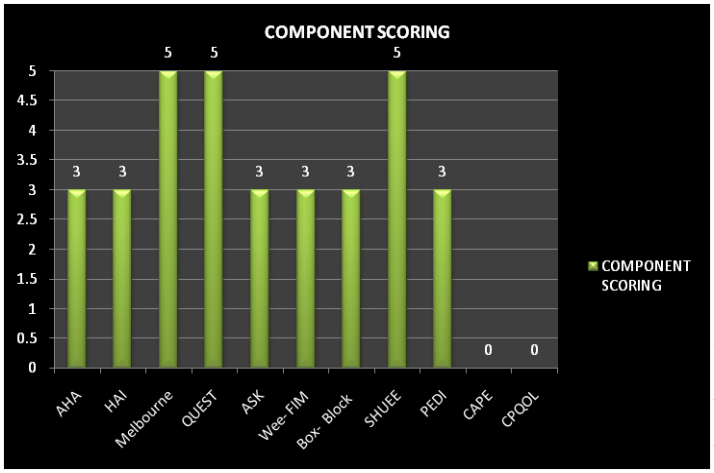
All steps in the selection and extraction processes (i.e., the study selection, data extraction and risk of bias evaluation)

were assessed independently by two reviewers. The titles and abstracts of all retrieved references were screened. The full texts of relevant publications were reviewed and were included if they met the inclusion criteria. The data from the included studies were extracted using a piloted data extraction form, which included information on the study population, outcome measures, components & features, Unimanual/ Bimanual, reliability and validity.

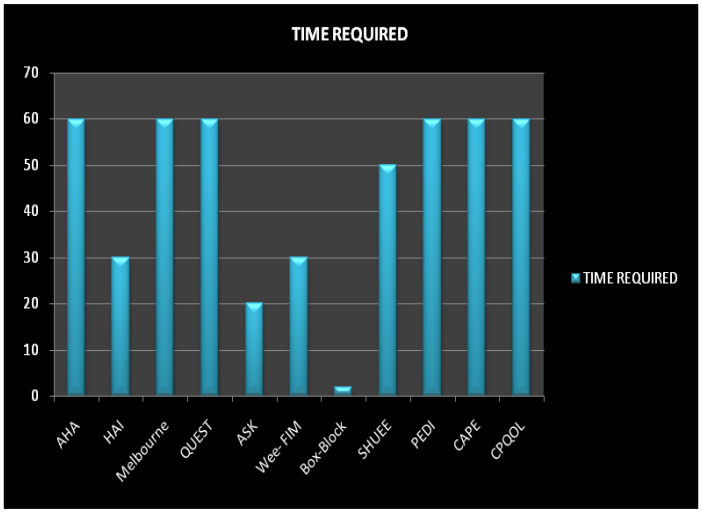
DATA ANALYSIS

Electronic databasewas searched by guide and investigator. The titles and abstracts of all the results were then screened for eligibility. The first screening process was aimed at narrowing down the articles by rejecting all the studies the are not relevant or appropriate according to inclusion. Duplicates were removed. A full-text version of all articles was evaluated.

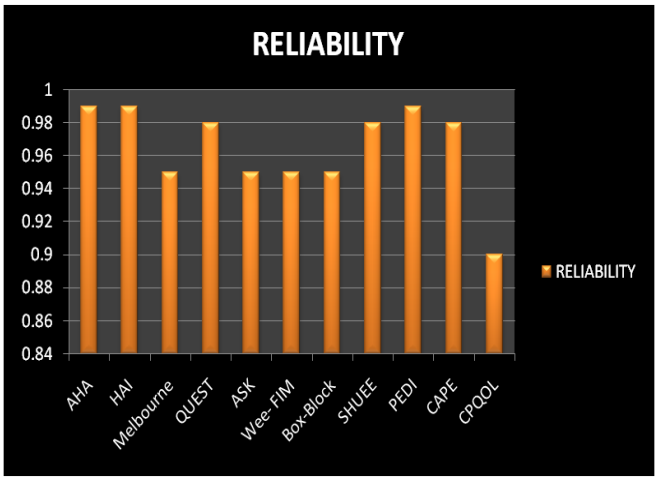
STATISTICAL ANALYSIS



Graph 1- showing scales with the highest component rating.



Graph 2- showing scales with respect to the time required.



Graph 3- showing scales with respect to their reliability

RESULTS

Several unique records of possible interest were revealed in the database searches. After screening titles and abstracts of identified papers, 15-20 records were included for a full-text check, others were excluded. Finally, one paper was added after screening the references, reviews, and published abstracts from conferences, and a total of 11 hand function measures were included for quality assessment. The included hand function measures were, Hand assessment for infants(HAI), Kids AHA, Melbourne hand assessment scale, QUEST, Activity skills for kids (ASK), Wee - FIM, Box- Block scale, Shrines hospital for children upper extremity evaluation (SHUEE), Pediatric evaluation of disability inventory(PEDI), The Children's Assessment of Participation and Enjoyment (CAPE), The Cerebral Palsy Quality of Life Questionnaire for Children (CPQOL-child). Out of these measures, 8 were performance measures-Hand assessment for infants(HAI), Kids AHA, Melbourne hand assessment scale, QUEST, Wee- FIM, Box- Block scale, Shrines hospital for children upper extremity evaluation (SHUEE) and Pediatric evaluation of disability inventory(PEDI)) and 3 were questionnaire- Activity skills for kids (ASK), The Children's Assessment of Participation and Enjoyment (CAPE) and The Cerebral Palsy Quality of Life Questionnaire for Children (CPQOL-child). **Graph 1**: Represents a component of the scale in a quantitative form (minimum score covering hand components and maximum score having shoulder girdle components included). It shows that the scales SHUEE, QUEST and Melbourne have maximum scoring. And as CAPE and CPQOL are questionnaires, they

had "0" scoring. **Graph 2**: Represents the time required by each scale.

The scale that required the least time was the box-block scale, requiring only 2 minutes of duration. The maximum time needed to be 60 minutes by scales- AHA, QUEST, CPQOL, CAPE, PEDI and Melbourne.**Graph 3:** Represents the reliability of the scales. The highest reliability was 0.99 of scales AHA, PEDI and HAI. Scale CPQOL had the lowest reliability with 0.9. Other scales had their reliability between 0.95- 0.98.

Overview of characteristics of hand function measures:-

HAI consists of 12 unimanual, 5 bimanual tasks, with a 3 point rating scale and is used in age (3-12 months). It is used to quantify hand difference in CP children.[2]**AHA** is used in kids with an age group of 18 months- 5 yrs, it has 22 components with a 4 point rating scale.[3]**Melbourne scale** used in the age group of 2-15 yrs, with 14 tasks and it requires 30 minutes of administration and 30 min. of scoring.[10,16]**QUEST**Scoring 0-100 is used in the age group of 18 months- 8 years, with 36 items, it evaluates head, shoulder, and trunk positions during grasp.[9,11]**The activity scale for kids (ASK)** is used in age 5-15 years, 30 items, 0-4 rating scale, 10 minutes required. It has a limitation that it requires patients with only musculoskeletal disorders and no cognition impairment.[5,6]**Wee- FIM** is used in age since birth to 7 years, it contains 18 items with a 7 point rating scale, the time required is <20 minutes. [12,17]**Box-block**is used in age group of 6-19 yrs of age, with no specific training needed, it requires <10 minutes duration and has established standardized kit, beginning with dominant hand[7,8]**Shrines hospital for children upper extremity evaluation (SHUEE)** used in age group 3-18 years, requires 15 minutes of duration, contains 16 tasks, functional analysis, dynamic positional analysis and grasp and release.[14,15]**Pediatric evaluation of disability inventory (PEDI)**is used in the age of 6 months- 7 years, 40-60 minutes of duration, 4 point rating scale.[12,13]The **Children's Assessment of Participation and Enjoyment (CAPE)**used in the age of 6-21 yrs, 55 items, requires 45-60 minutes of administration. It has a limitation that it needs to be filled by a clinician who knows the child; Long: takes 15-20 minutes to complete; Costly; Administration depends on the child's ability to fill out a questionnaire. [20,21] **The Cerebral Palsy Quality of Life Questionnaire for Children (CPQOL-child)** a 53-question child self-report version for children between 9 and 12 years of age and a 66-question parent proxy report for children between 4 and 12 years of age.[18,19]

With respect to clinical use, nine of the tools were specifically designed for use in subjects with CP (HAI, AHA, CHEQ, CPQOL and SHUEE). The remaining tools were designed for use in subjects with a range of diagnoses (including CP).

DISCUSSION-

Clinicians interested in the evaluation and treatment of the UE in children with CP must choose from a wide range of ofassessment tools. Familiarity with the psychometric and clinometric properties of an assessment tool greatly enhances a clinician's ability to select and use these tools in daily clinical practice for bothclinical decision-making and assessment of outcome. There are a number of specific limitations related to the literature, some related to our review, and others related to the instruments themselves. Critical analysis of the multidimensional nature of the assessment tools and their application as instruments for outcomeassessment requires expertise across multiple medical and psychosocial fields. A review of the relevant literature requires access to multiple medical and professional journals. Comparing and contrasting studies is complicated bythe variable clinical, methodological, and analytical parameters used by the various journals.

The aim of our recent study was to evaluate various hand function assessment measures that are used in the assessment of hand function impairment in children with cerebral palsy and note and compare the advantages and disadvantages. Our studywas limited to evaluating instruments found in the English literature. With respect to content, the tools evaluated in the current review covered a wide range of ages. The toolsaddressed multiple characteristics of hand performance measures in 2 categories:- performance measures and questionnaire. It consists of hand movement, grasp, release, and the child's ability to manipulate the objects. With respect to method, all of the tools had publishedevidence of reliable. However, the quality of reliability analyses varied greatly.

In this recent analysis, QUEST, SHUEE and Melbourne hand

assessment scale proved to be better measures of hand function children with CP in the aspect of characteristics of performance measure and reliability except for the time required by scale. As per our evaluation these scale assesses variables not only for the hand but also considers shoulder girdle as an important component of an assessment tool for the quality assessment.

As per the study was done by Carol DeMatteo et al. in 2009 proved that the**Quality of Upper Extremity Skills Test (QUEST)** was developed to overcome limitations of currently available measures of hand function. This measure evaluates the quality of upper extremity function in four domains: dissociated movement, grasp, protective extension, and weight bearing. But, it is very costly and also requires 55-60 minutes in testing.[9,11]

Also, another study carried out in 2003 by Bourke-Taylor H. was done which said that the **Melbourne Assessment of Unilateral Upper Limb Function (Melbourne Assessment)** is an evaluation tool that objectively measures upper-extremity function in children with cerebral palsy (CP). This study investigates how well performance on the Melbourne Assessment relates to the child's actual performance in functional tasks in the age group of 5 to 14 years. The Melbourne Assessment demonstrates excellent construct reliability for upper limb functioning. It requires 60 minutes in administration and scoring and is not cost effective.[10,16]

One of the other studies was also done in 2006Davids JR[1] etal. said thatthe **Shriners Hospital for Children Upper Extremity Evaluation (SHUEE)** is a video-based tool for the assessment of upper extremity function in children with hemiplegic cerebral palsy. This tool includes spontaneous functional analysis and dynamic positional analysis and assesses the ability to perform grasp and release. It requires 45-50 in testing and is costly.[14,15]

Further Melbourne assessment tool and SHUEE is used to evaluate only affected extremity that's the reason they were applied especially on hemiplegic CP children. Whereas QUEST is a quality assessment tool for bilateral upper extremity and it is applicable for all types of cerebral palsy. .With respect to reliability, QUEST and SHUEE proved to have better reliability than Melbourne hand assessment scale another thing these require about an hour in administration and are costly measures.

The scales other than these 3 scales had their own advantages. Such as, the box-block scale requires only 2 minutes of administration and doesn't require a specialized trainer. HAI is used to quantify the hand differences in cp. They assessed the factors including events of ADL's such as, locomotion, self-care, communication and social cognition. [2,7,8]

Clinicians and other investigators should recognize that a range or combination of measures may be required to evaluate UE function and perception of performance in children with CP. Instrument selection must account for the needs of the population being treated and the interventions under consideration. In children with cerebral palsy, the affection of upper extremity includes shoulder, elbow, wrist, fingers and thumb function. Simultaneously, trunk position and movement also plays a huge role in upper extremity functioning. Grasp, release, locomotion, object transfer, ADLs, are the main components to focus on, while assessing UE function in children with CP.

It is hoped that this review will facilitate the selection and use of assessment tools in daily clinical practice, promote the critical assessment of study design in professional journal articles, and encourage the development of new and improved outcome instruments for the UE in children with CP which will also be cost effective to the developing country like India.

CONCLUSION-

The present review concludes that the **Melbourne hand assessment scale, SHUEE** and **QUEST** proved to be best hand assessment measures in children with cerebral palsy with good reliability and considers all the components in hand function assessment.

CONFLICT OF INTEREST- None.

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