

SHUEE ON THE EVALUATION OF UPPER LIMB IN CEREBRAL PALSY

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ABSTRACT

Objective: To demonstrate the use of the tool for evaluation of spastic upper limb SHUEE (Shriners Hospital Upper Extremity Evaluation) in the evaluation of upper limb in cerebral palsy (CP) and its ability to detect changes after surgical treatment of identified deformities. **Methods:** 19 patients with spastic hemiplegic CP had their upper limb evaluated by SHUEE. Five patients underwent surgical treatment of deformities detected and performed the test at one year postoperatively. **Results:** The mean age was 9.02 years old; 18 patients were classified as level I GMFCS and one patient as level II. At baseline, the mean spontaneous func-

tional analysis was 59.01; dynamic positional analysis was 58.05 and grasp-and-release function, was 91.21. In the postoperative period the scores were, respectively, 65.73, 69.62 and 100, showing an improvement of 3.5% in the spontaneous functional analysis and of 44.8% in dynamic positional analysis. **Conclusions:** SHUEE is a tool for evaluation of spastic upper limb in cerebral palsy that helps in the specific diagnosis of deformities, indication of treatment and objective detection of results after surgical treatment. **Level of Evidence IV, Case Series.**

Keywords: Cerebral palsy. Disability evaluation. Upper extremity.

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INTRODUCTION

The upper limb (UL) assessment in cerebral palsy (CP) is often based on the account of its functionality by the caregiver or patient and physical examination, which usually is restricted to the analysis of passive and active range of motion, presence of fixed or dynamic deformities, sensitivity and stereognosis. Functional aspects, where limitations caused by dynamic or fixed deformities clearly appear, are rarely analyzed, especially objectively. Thus, diagnosis, treatment and outcomes measurement continue to be made in a variable and non reproducible way.¹ As for the study of gait, the video observation for UL evaluation seems to have great importance in diagnosis and treatment planning, since it allows a more accurate understanding of abilities and deformities.²

In order to improve the understanding of limitations and deformities, assisting in the process of treatment planning and measurement of results, various tools have been described. Quantitative methods such as three-dimensional analysis (kinematics), biomechanical modeling and electromyography, constitute the gold standard, but are unavailable in most centers. Besides those, several other tests for quantitative evaluation of UL in CP have been described. Most of them take more account of the presence or absence of ability to

perform a certain task than the means by which it is undertaken, i.e., the main abnormal dynamic aspects presented are not analyzed. Some tests have no known validation, are not specific for CP, are not specific for children and adolescents and do not provide direct treatment indications.¹⁻²⁰

The Shriners Hospital Upper Extremity Evaluation (SHUEE) was published in 1996.¹⁰ It is a form of objective assessment of UL based on video analysis, described for 3-18 year old patients with spastic hemiplegic cerebral palsy (SHCP). This test has been used for assessment, treatment planning and measurement of treatment outcomes. Its differential is to value the dynamic aspects of the deformities and functional limitations present in spastic UL, assisting in the demonstration of the aspects that have treatment indication, as well as its directing. Moreover, its performance after treatments serves as a method to clearly and objectively evaluate the outcomes. SHUEE basically analyzes spasticity, arc of movement, muscular strength, spontaneous functional analysis (SFA), positional dynamic analysis (PDA) and the grip-release function (GRF). The performance mode in the various tasks is assessed and percentage scores are given for the last three functions. According to the scores obtained, the therapeutic planning is performed: conservative - focal treatment of spas-

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ticity by botulinum toxin type A; or surgical - wrist arthrodesis, transfers or muscle releases. According to other findings, other treatment indications may arise, such as use of orthotics, etc. SHUEE has excellent inter and intra-observer reliabilities verified by the evaluation of eleven 6-13 year old patients with hemiplegic cerebral palsy (HCP); the concurrent validity was assessed by comparing SHUEE to the Pediatric Evaluation of Disability Inventory (PEDI), and the Jebson-Taylor Hand Function Test (JTT) in twenty 6-15 year old patients with PCH; construct validity was determined by analysis of the pre and post-surgical scores in the wrist of 18 children with HCP.^{10,11} The objective of this study was to demonstrate the use of SHUEE, illustrating its use in the initial evaluation process and following cases which received surgical treatment.

MATERIALS AND METHODS

A retrospective study of medical records analysis of patients who underwent evaluation of UL by SHUEE from January 2009 to December 2013 was undertaken. The study included all patients with spastic hemiplegic cerebral palsy (SHCP) aged 3 to 18 years who underwent SHUEE in the referred time period. SHUEE consists of two stages: the first stage consists of a physical examination scoring spasticity by the Ashworth scale, and range of motion with a goniometer, besides the evaluation of independence in performing activities of daily living; in the second stage 16 manual function tasks are recorded in video. These videos are jointly analyzed to score SFA, PDA and GRF. SFA scores spontaneous function of hemiplegic UL in nine activities, with scores from zero to five; zero meaning no use of the hemiplegic UL, and five meaning spontaneous partial or full use of the limb. PDA uses 0-3 scores to classify the type of deformity in 16 tasks in UL segments (thumb, fingers, wrist, forearm and elbow).¹⁰

Patients and their parents or caregivers were informed about the objectives and test performed and provided Free and Informed Consent forms. After the tests the patient and his family or caregiver were informed in details about the tests findings, as well as their impact on planning the forthcoming treatment. They received a copy of the final report and the tests videos.

The research project was approved by the Research Ethics Committee of *Círculo Operário Caxiense, Faculdade da Serra Gaúcha*, Caxias do Sul, RS, Brazil. We used descriptive statistics with mean and standard deviation measurements.

RESULTS

Nineteen patients with SHCP performed SHUEE according to the original protocol described, nine of them (47%) were males. The right side was affected in 13 patients (68%). The mean age of participants was 9.07 years old (St. Dev 2.47 years old). Eighteen patients (95%) belonged to level I of the Gross Motor Function Classification System (GMFCS) classification, and one patient (5%) was level II.

Nine patients (47%) underwent surgical treatment of identified deformities and indicated by SHUEE, and of these, five (26%) underwent a new evaluation one year after surgery.

In the initial evaluation (n=19), the average SFA was 59.01 (St. Dev. 14.87), PDA 58.05 (St. Dev 18.68) and GRS 91.21

(St. Dev 26.81). The results of assessments carried out in the sample of individuals who underwent surgical procedure are shown in Table 1. Postoperatively, the average SFA was 65.73; PDA, was 69.62 and GRF was 100, with a mean improvement of 3.5% in SFA and 44.8% in PDA. The grip and release function was 100% for all individuals who underwent surgery and did not change thereafter. In two cases the operated patients did not show improvement in SFA and four, in PDA.

Table 1. Pre- and post-operative assessment by the SHUEE method.

Id	Age (years old)	SFA			PDA		
		Pre	Post	Improvement (%)	Pre	Post	Improvement (%)
1	7.7	66	76	15.15	55	83	50.91
2	8.8	60	57.77	-3.33	41	86.11	109.76
3	6.4	69	66	-4.35	54	54	0.00
4	11.9	56	62	10.71	49	56	14.29
5	7	67	67	0	42	70	66.67

SHUEE: Shriners Hospital Upper Extremity Evaluation; Id: Patient's identification; SFA: Spontaneous functional analysis; PDA: Positional dynamic analysis; %: percentage; Pre: Pre-operative assessment; Post: Post-operative assessment.

DISCUSSION

The gold standard for CP movement assessment is three-dimensional analysis, primarily regarding gait. Some centers study their use to evaluate the mobility of UL, searching for systematic movement patterns, which makes the method objective and reproducible for clinical assessment of functional performance of UL.¹

More often, however, despite the existence of various functional tests described, the evaluation of UL in CP remains, in most cases, incomplete, taking into account only static aspects such as measurement of range of motion, the degree of spasticity and description of fixed deformities. Detailed functional aspects are not routinely assessed, making it difficult to draw up a treatment plan that aims to functional improvement, including the treatment of major deformities found. Moreover, the lack of essentially objective criteria affects the evaluation of the outcomes.

The literature suggests several tests that evaluate the deformities and the function of UL spasticity in CP. The Manual Ability Classification System (MACS) describes how children with cerebral palsy use their hands to manipulate relevant and appropriate objects for their ages in the activities of daily living, classifying them into five levels. It is a functional description, it does not use videos and does not explain the pathological mechanisms involved in movement deficiencies.¹⁸

The Assisting Hand Assessment (AHA) measures and describes the use of the affected hand in bimanual activities for 18 month to 12 year old children with unilateral abnormalities (due to CP or obstetric paralysis). Using videos, it assesses 22 items, using a four-point scale. The test does not aim to diagnose deformities and the scores are not directly used for therapeutics decision making.^{12,13}

The Quality of Upper Extremity Skills Test (QUEST) is another test that assigns scores to four areas (movement dissociation, prehension, support and protective extension), and it is described as auxiliary for planning treatment, since it describes the quality of movements of both limbs, also being useful for evaluating therapeutic results. It does not use footage, and items are assessed as yes/no and subsequently, scores are attributed.¹⁹

The Melbourne Assessment of Unilateral Upper Limb Function (MUUL) was originally designed for 5 to 15 year old children with unilateral neurological disorders; it measures the quality of motor function. It can be applied also in the dominant UL. Scores are applied by studying videos. There is no mention on how the scores assist in therapeutic proposals.⁸

Although used as an evaluation tool for children as young as eight years old including, but not solely, CP diagnosis, the Jebsen-Taylor test was initially developed to assess adults with neurological or musculoskeletal disease and it consists of seven tests. It measures the time a person takes to perform the task and the outcome is compared to normal criteria. There are no videos or direct use of the score in the process of treatment decision.²⁰

Unlike other tests, SHUEE is able to demonstrate not only whether the individual can accomplish a task, but also how he performs it, highlighting the pathological motor components. The diagnostic reasoning is complemented also by objective measurements of muscle strength, arc of movement and spasticity. This generates information relevant to treatment decision making, and to evaluate the results in an objective and reproducible manner. The importance of video acquisition allows repeated viewing of a particular movement and deformity, decreasing the chance of their misinterpretation. The importance of acquiring images for later study, classification and interpretation has also been demonstrated by Carlson *et al.*² In this study, the use of video images changed the initial treatment plan for 72% of patients, particularly regarding to interventions in the wrist, fingers and thumb.²

In a systematic review on evaluation methods of UL activity in hemiplegic CP, SHUEE is cited among ten other tools. According to this review, SHUEE is the only test that provides a detailed analysis of the thumb, fingers, wrist, forearm and elbow position and this aspect is particularly relevant to support the indication of an intervention such as botulinum toxin or surgery and to measure their effects.¹⁷

Another systematic review identified five evaluations that measure different components of UL activity that are suitable for use in children with hemiplegia: ABILHAND-Kids, AHA, MUUL, QUEST and SHUEE. This study reports that the SHUEE validation article uses Jebsen-Taylor and PEDI to analyze the concurrent validity, though these evaluations are not accepted as standard criteria for UL activity measures. It also points out the great inter and intra-observer reliability of SHUEE.⁶

The classic UL spastic deformities in SHCP are known, however their structural causes and the influence of each of the functional limitations found should be evaluated individually and in detail in order to plan the best therapeutic approach. In SHUEE, limiting pronation, extension of the elbow, wrist and fingers, the presence of ulnar deviation during wrist extension, and thumb adduction positioning are analyzed and scored during while performing various tasks, clarifying and directing treatment indications, conservative or surgical.¹⁰

In the original SHUEE study, the treatment indications were based on SFA scores (score 1 indicates wrist arthrodesis and scores 3, 4, 5 indicate tendon transfer or botulinum toxin application), PDA scores (scores 0 or 1 in four of four tasks indicate wrist arthrodesis; wrist in a neutral position in at least two of four tasks indicate tendon transfers or botulinum toxin application) and the grip-release function (inability to grip-release in any position of the wrist indicates arthrodesis; grip-release with wrist in neutral or flexed position, but not in extension, indicates transfers and/or surgical releases).¹⁰ In our study, SHUEE helped in indicating therapeutic procedures and was also used to evaluate the outcomes of cases that received indication to and underwent surgical treatment.

In 2009, Davids *et al.*¹¹ retrospectively evaluated the relationship between the static and dynamic thumb assessment from SHUEE in 33 children with SHCP before and after two years and two months, on average, of surgical treatment, which included soft parts and/or bone procedures. They concluded that the preoperative dynamic examination showed worse than the static one. After surgery, an improvement of both components was observed, mostly in the static component. They also noticed a poor correlation between the spontaneous use of the limb preoperatively and the dynamic changes found after surgery. The study showed improvement in static and dynamic aspects after surgical treatment of thumb deformities in 82% and 61% of patients, respectively. These facts demonstrate that the treatment planning should not be based on static examination of the thumb and that improvement in static and dynamic alignment can be obtained regardless of the existing level of neurologic deficit. These conclusions were possible through the use of this evaluative tool, which details the static and dynamic aspects objectively, making it possible to compare the generated data.¹¹

To date, few studies are found in the literature using SHUEE for evaluating UL in CP.^{3-6,10,17}

CONCLUSION

Our study shows the importance of using an assessment tool in evaluating UL spasticity in specific diagnosis of existing deformities, on indication of treatment and follow-up with objective record of outcomes. The phases of this process, from the initial assessment up to measurement of outcomes were possible by using SHUEE, which was sensitive to detect the postoperative outcomes. Studies with larger samples, with methodologies with the highest level of evidence and including other treatment modalities are needed.

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