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# Analysis of Minimal Detectable Change and Minimally Clinical Important Difference of Bruininks-Oseretsky Test of Motor Proficiency Second Edition [Bot-2] for Manual Dexterity Component in Cerebral Palsy Patients

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## ABSTRACT

**Introduction:** Cerebral palsy is a group of permanent disorders affecting the development of movement and posture causing activity limitation, which is attributed to non-progressive disturbances that occurred in the developing fetal or infant brain.
Manual dexterity is the ability to make coordinated hand and finger movements and it requires both gross and fine hand motions and coordination. Children with CP usually have difficulties performing manual activities such as grasping, releasing or manipulating objects, which is crucial in the performance of many activities of daily life.
**Method:** In this Study total 20 cerebral palsy patients both male and females were selected between the age group of 4-21 years. Bot-2 tests for manual dexterity were done and the total scores were calculated. The Minimal Detectable Change was calculated using a formula and Minimal Clinically Important Difference was calculated using Receiver Operating curve analysis.
**Results:** The Minimal Detectable Change [MDC] was captured with a confidence level of 95% Minimal Clinically Important Difference [MCID] was calculated using Receiver Operating curve analysis and MDC value is 3.6755 and MCID value is 0.925.
**Conclusion:** The study indicates excellent value for MCID in Bot-2 compared to PMAL in Manual Dexterity. The clinometric properties of MDC And MCID provided in this study allow clinicians and researchers to determine if a change score indicates a true or clinically meaningful effect at post treatment and at follow-up.

***Keywords:*** [Cerebral Palsy, Manual dexterity, Bruininks-Oseretsky test of motor proficiency, Minimal Detectable Change, Minimal Clinically Important Difference.]

## INTRODUCTION

Cerebral palsy (CP) is a group of permanent disorders affecting the development of movement and posture causing activity limitation, which is attributed to non-progressive disturbances that occurred in the developing fetal or infant brain.[1] The most common disorders are: abnormal muscle tone, muscle weakness, random and uncontrolled body movements, balance and coordination problems [1].
The prevalence of CP in all live birth's ranges from 1.5 to 3 per 1,000 live births; varies between high-income and low- and middle-income countries, as well as by geographic area [1].

Bruininks-Oseretsky test of motor proficiency [BOT-2] was developed to measure gross and fine motor skills. It is composed of 53 test items under 8 subtests including fine motor control, manual dexterity, bilateral coordination, balance, running speed and strength. The BOT-2 is a commonly used diagnostic instrument in the evaluation of the development of psychometrics in the age range from 4 to 21[2]. The Manual Dexterity subtest of BOT-2 consist of 5 sub-items.

Manual dexterity is the ability to make coordinated hand and finger movements to grasp and manipulate objects of all shapes and sizes. Manual dexterity includes muscular, skeletal and neurological functions to produce small Manual dexterity tasks requiring both gross and fine hand motions and coordination. Children with CP usually have difficulties performing manual activities such as grasping, releasing or manipulating objects, which is crucial in the performance of many activities of daily life. and precise movements, such as handwriting, playing a musical instrument or, in our case, safely perform surgical procedures.

The Minimal Detectable Change [MDC] has been defined as the smallest amount of change that is greater than measurement error.[4] The measurement error is defined the systematic and random error of a participant's score that is not attributed to true changes in the construct to be measured. It was calculated with a confidence level of 95% as follows:

MDC 95 = 1.96 ×V2 × SEM = 1.96 × SD ×2 (1 − ICC),

where SEM is standard error of the measurement, SD is standard deviation, and ICC is the coefficient of the test–retest reliability. Another measure of clinical relevance is Minimum clinically important difference [MCID] .The term MCID was first defined by Jaeschke etc. as 'the smallest difference in score in the domain of interest which patients perceive as beneficial and which would mandate, in the absence of troublesome side effects and excessive cost, a change in the patient's management'[5].There are two methods to determine MCID which include Anchor based method and Distribution based method .Anchor-based methods involve comparing the change in the situation of a patient as captured by an out- come measure to an external criterion. The anchor-based approach of the MCID requires the identification of important degrees of improvement with an external standard. [3,4] The QOM of the Pediatric Motor Activity Log [PMAL] was used as an anchor to establish the MCID value of the BOT-2 to reflect the subjective perception of improvement. Test- retest reliability of both scales was high (the intraclass correlation coefficient for the How Often scale was 0.94, and for the How Well scale 0.93). The PMAL, a parent-reported outcome measure, consists of 22 daily activities, including unilateral and bilateral tasks, to capture fine to gross motor functions in children with CP. The anchor-based MCID was calculated as the mean change score of the PMAL, corresponding to children who were defined as having minimal clinically important difference.[7]

The MDC and MCID can support effective decision- making.[6]

The purpose of this study was to Calculate the minimal detectable change of and minimal

clinically important difference of Manual Dexterity Component using BOT-2.

## MATERIALS & METHODS

Experimental study was done on 20 samples of spastic diplegics and data was collected according to the inclusion and exclusion criteria. Study was approved by the ethical committee. The nature of study was explained and written consent was obtained from the parents prior to the study.

**Inclusion criteria:**

1. Spastic diplegics
2. Both male and female children

3. Children who are able to follow commands

**Exclusion criteria:**

1. Parents who are unwilling to participate.
2. Auditory and Cognitive impairments.

**Procedure**

The Manual Dexterity subtest of Bruininks-Oseretsky test of motor proficiency [BOT-2] consist of 5 sub-items including

1. Making dots in circle
2. Transferring pennies
3. Transferring pegs into a pegboard
4. Sorting cards
5. Stringing blocks.

Bot-2 tests for manual dexterity were done and the total scores were calculated. The Minimal detectable change value was calculated using the formula. The MDC was captured with a confidence level of 95% MDC and MCID was calculated using ROC (receiver operating characteristic curve) using NCSS software.

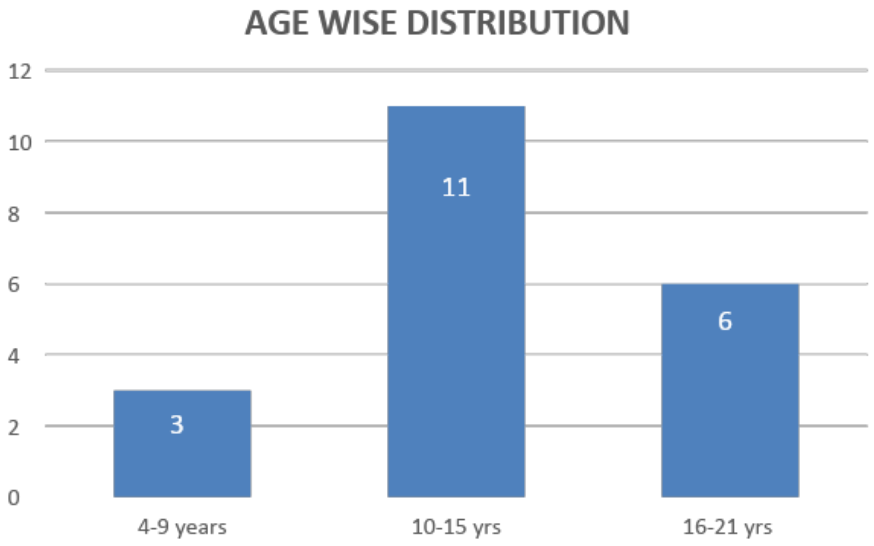
## STATISTICAL ANALYSIS

The present study aimed to Calculate the minimal detectable change of and minimal clinically important difference of Manual Dexterity Component using BOT-2. The study included 20 participants both male and females between the age group of 4-21 years. Bot-2 tests for manual dexterity were done and the total scores were calculated. The Minimal detectable change value is calculated using the formula. The MCID is calculated using the roc curve (receiver operating characteristic curve) using NCSS software. An ROC (Receiver Operating Characteristic) curve is a graphical representation of the performance of a binary classification model. It plots the true positive rate (sensitivity) against the false positive rate (1-specificity) at different classification thresholds.

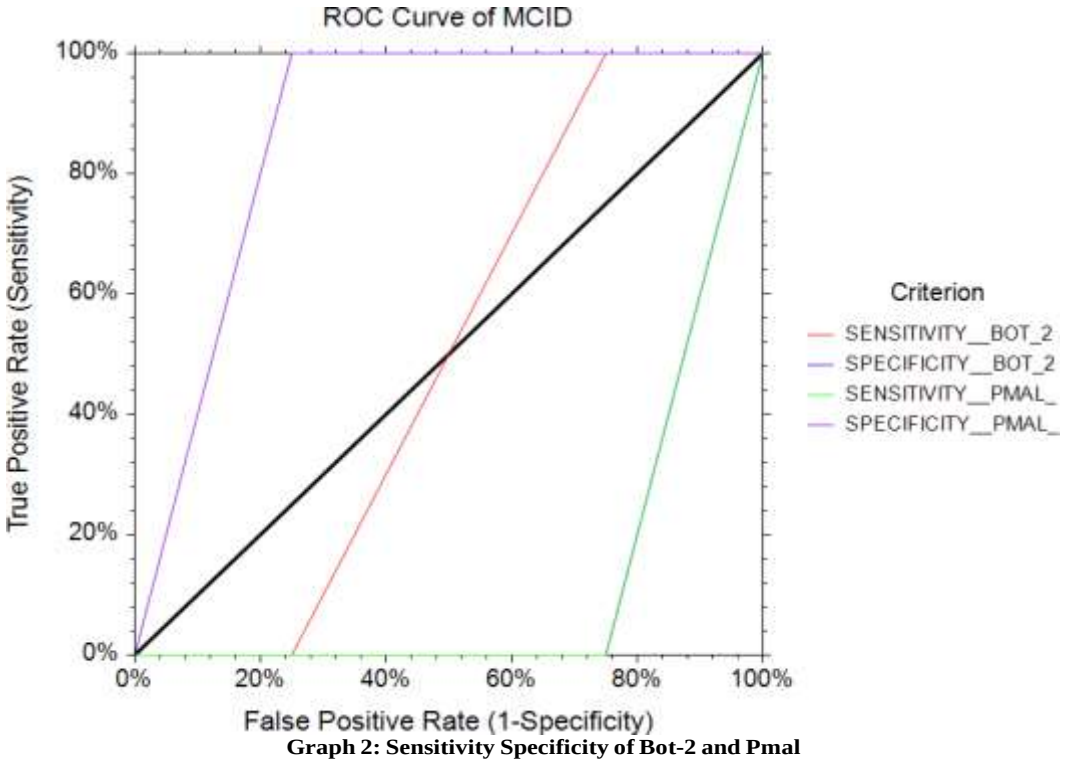
The MDC was captured with a confidence level of 95% MDC and MCID was calculated using ROC curve analysis and MDC value is 3.6755 and MCID value is 0.925.

**Age wise distribution**

20 patients, between the age group 4-21 years with Diplegic Cerebral Palsy were selected according to inclusion and exclusion criteria and data analysis was done. In the total 20 counts,3 was in the age category of 4-9 years,11 was in the category of 10-15 years and 6 were categorized in 16-21 years age group.




**Graph 1: Roc Curve of Mcid**




**Graph 2: Sensitivity Specificity of Bot-2 and Pmal**

| Criterion | Count | AUC | Std Error | Z-Value to Test AUC>0.5 | P-Value | Upper 1-Sided 95% confidence limits | Lower | Upper |
|---|---|---|---|---|---|---|---|---|
| Sensitivity BOT-2 | 0.6000 | 0.2041 | 0.000 | 0.5000 | 0.0159 | 0.7942 | | |
| Specificity Bot-2 | 0.3250 | 0.1250 | -3.000 | 0.9987 | -0.1226 | 0.3580 | | |
| Sensitivity PMAL | 0.1250 | 0.1250 | -3.000 | 0.9987 | -0.1226 | 0.3580 | | |
| Specificity PMAL | 0.6750 | 0.1250 | -3.000 | 0.0013 | -0.2993 | 0.9837 | | |

**Table 1: Sensitivity and Specificity of BOT-2 and PMAL**

| SD | n | SEM | MDC 95 | MCID |
|---|---|---|---|---|
| 5.954014 | 20 | 1.33 | 3.6755 | 0.0925 |

**Table 2: Results of the MDC95 and MCID values of manual dexterity using bot-2 are shown in table 2.**

## DISCUSSION

The objective of this study was to find out MDC and MCID USING BOT-2 for Manual Dexterity in Cerebral Palsy patients. This Study includes BOT-2 i.e., the Bruininks-Oseretsky Test of Motor Proficiency Second Edition (BOT-2) which assesses the psychomotor development. It is a commonly used diagnostic instrument in the Evaluation of the development of psychometrics in the age range from 4 to 21. Bruininks-Oseretsky test of motor proficiency was developed to provide educators, clinicians and researchers with useful information to assist them in assessing the motor skills of individual students, in developing and evaluating motor training programmes, and in assessing serious motor dysfunctions and developmental handicaps in children. Hence the present study is conducted to assess the gross and fine motor components of motor proficiency in spastic cerebral palsy children. For Manual Dexterity Five components from BOT-2 were used i.e., Making dots in circles, transferring pennies, Placing pegs into a pegboard, Sorting Cards, Stringing Blocks.

These tools were used to calculate BOT-2 score in Manual dexterity component of the participants. The MDC has been defined as the smallest amount of change that is greater than measurement error. CID was first defined as 'the smallest difference in score in the domain of interest which patients perceive as beneficial and which would mandate, in the absence of troublesome side effects and excessive cost, a change in the patient's management. In this study we have used Anchor Based approach to calculate MCID. Anchor-based methods involve comparing the change in the situation of a patient as captured by an out-come measure to an external criterion. In this study we have used PMAL i.e., Pediatric Motor Activity log which is used as external criteria for assessment of manual dexterity. PMAL uses How Often and How well scales, the intraclass correlation coefficient for the How Often scale was 0.94, and for the How Well scale 0.93.

Based on the MDC and MCID values identified in this study, clinicians and researchers may be able to determine whether a change score indicates a true or clinically meaningful effect at post-treatment and at follow up. Our findings provide clinicians with the BOT-2 benchmarks needed for clinical decision making and for bridging the gap between evidence and practice. Researchers and clinicians can use the MDC of BOT-2 determined in this study to estimate the effectiveness of treatment and to evaluate outcomes. The MCID values indicate clinically meaningful differences or changes in therapeutic effects.

The MDC value is calculated using a formula MDC 95 = 1.96 × √2 × SEM. and MCID value is calculated using statistical analysis and ROC curve. An ROC (Receiver Operating Characteristic) curve is a graphical representation of the performance of a binary classification model. It plots the true positive rate (sensitivity) against the false positive rate (1-specificity) at different classification thresholds. ROC Curve of MCID Suggests the Value of Area Under Curve of Bot-2 Is 0.925 And PMAL Is 0.7.

This Indicates That Bot-2 Is an Excellent Outcome Measure to Estimate MCID as compared to PMAL. The MDC90 Value is 3.6755. The MCID Value is 0.925.

## CONCLUSION

The study indicates excellent value for MCID in bot-2 compared to PMAL In Manual Dexterity. The clinometric properties of MDC And MCID provided in this study allow clinicians and researchers to determine if a change score indicates a true or clinically meaningful effect at post treatment and at follow up. The MDC and MCID values could be helpful in understanding therapeutic effects and evaluating manual dexterity using BOT-2.

### Limitations

The limitations of the study design include the participant characteristics and the outcome measures.

Children with MACS levels I–IV were included in the data analysis, and those with MACS level V were excluded. This study can also be used to estimate all the Eight subtests of BOT- 2. The study results cannot be generalized to all children with CP. And this study did not measure participation-level outcomes or health related quality of life.

### *Declaration by Authors*

**Ethical Approval:** Approved

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**Conflict of Interest:** The authors declare no conflict of interest.

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