



(RESEARCH ARTICLE)



Motor development and functional ability for children with cerebral palsy: A new tool for functional measure

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Abstract

The paucity of adequate tool available for documenting therapeutic effectiveness surfaces as major problem. An initiation is being taken to develop an appropriate tool which can evaluate motor development and functional ability of children with Cerebral palsy appropriate to Indian culture and society.

Aim: To develop an assessment tool for analysing motor development and functional ability of children with Cerebral palsy.

Objectives: (i) To develop Psychometric property and evaluate the psychometric property of the tool. (ii) To check the reliability and validity of the tool developed.

Material and method: Tool development was conducted in three phases, Phase 1- development of 64 items in three domains. Expert review was undertaken and correction of the content was done through discussion with experts. Phase 2- content validity and face validity have been established. Phase 3 - concurrent validity, has been established by correlating with GMFM.

Result: 64 items were generated under three stages: Infant (20), Toddler (36) and Preschooler (8). Content validity index at item level and Scale level were significantly high (> 0.80) for agreement in Clarity, Essential and Relevancy. The face validity of the tool was evaluated. Each item was under full agreement category (90% -100%) in formatting, clarity, and appropriateness of the item for children with CP. Test-retest, interrater and concurrent validity of the tool is significantly acceptable.

Conclusion: The new tool may be considered as an effective measure which is suitable in children with CP.

Keywords: Cerebral Palsy; Motor development; Disability; Therapeutic; Concurrent; Psychometry

1. Introduction

Scales are a manifestation of latent construct, they measure behaviors, attitudes, and hypothetical scenarios we expect to exist as a result of our theoretical understanding of the world, but cannot assess directly.¹

Tools are typically used to capture a behavior, a feeling, or action that cannot be captured in a single variable or item. Thousands of scales have been developed that can measure a range of social, psychological, and health behaviors and experiences. As science advances and novel research questions are put forth, new scales become necessary.²

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The paucity of adequate tool available for documenting therapeutic effectiveness surfaces as major problem. Cerebral palsy is the most common motor disability in childhood with prevalence rate 3 per thousand live births in developing countries, often treated by health care professionals.³ To be as accurate as possible in the evaluation of functioning, a proper measuring instrument have to be used.

Gradually increasing need for adequate patient centered outcome measure, specially disease or population specific scale rather than generic measure.

ICF model helps us to expand our thinking beyond fixing primary impairments to a view that place equal value on promoting functional activity and facilitating the child's full participation of life.⁴ Most of the cerebral palsy assessment Tools developed and tested in western societies focus on infant and young children.

In essence, the priorities of active participation in age specific functional activities and cultural need to be determine during tools development. Therefore, an initiation is being taken to develop an appropriate tool which can evaluate Motor Development and Functional Ability for children with cerebral palsy suitable for Indian culture and society focused.

Aim

To develop an assessment Tool for analysing Motor Development and Functional Ability for children with Cerebral Palsy.

Objectives

- To develop psychometric property and evaluate the psychometric property of the tool.
- To check Reliability and Validity of the tool developed

2. Material and methods

2.1. Research Design

Quantitively focused, sequential and exploratory mixed methods of design was used.

2.2. Sampling Method

Purposive sampling was used for selection of subjects from hospital and clinic set up, special school for CP children for Group A. Normative data of normal children was collected from parent volunteers and from normal school for Group B. Ethical committee approval from organisations and parent consent form was filled by parents of participated children.

2.3. Sampling Size

The total sample size was 60.

Source of Data: Data was collected from SVNIRTAR, hospital and clinic for CP children for Group A. Normative data of normal children was collected from parent volunteers and from normal school for Group B.

2.4. Inclusion Criteria

- Age: 3 Months to 5 Years
- Both male and female subjects who are clinically diagnosed with Cerebral Palsy for Group A.
- Subjects who are different severity level as per GMFCS.
- Subjects with normal motor development and function for Group B.

2.5. Exclusion Criteria

- Subjects who are severe mental retarded and not be able to understand age appropriate simple commands.
- Subjects who have congenital anomalies that effect motor development and functional abilities.
- Subjects who have severe and frequent Epilepsy.

2.6. Outcome measures

- GMFM (Gross motor functional measure) – 88.³
- New Developed Tool (FAMC)

The new tool is an individually administered test that assesses the motor development and functional ability of children from 3 months to 5 years of age. The assessment tool comprises of 64 items. The items belong to 3 subareas: 1. Infant stage (3 months -12 months) 2. Toddler stage (12 months - 36 months) 3. Preschooler stage (36 months - 5 years). 20 items belong to infants, 36 items belong to toddlers, and 8 items belong to preschoolers.^{6,7,8.}

- **Procedure** -Tool development Steps were followed as per the format proposed by Boateng and steps guided by Devellis.^{2,1}

2.7. Item development

Identification of domain - Motor Development and Functional Abilities of Children

2.7.1. Item generation

Developed questions that were suitable for age-appropriate motor development and functional ability of children. The procedure was followed by deduction and Inductive methods. 64 numbers of items were generated. Four-point ordinal Scale (0,1,2 and 3) was designed to grade and quantify the quality of responses. Testing of Content validity was performed and quantify assessments of 11 expert judges to formalizing of the scaling.⁹ Face validity has been established by 11 evaluators.¹⁰

2.7.2. Scale Development

Initially a pilot study was performed for testing of content validity of the items. Test-retest and intra- ratter were used for data collection. In Group A - 30 children with cerebral palsy were allotted and in Group B- 30 normal children was allotted. Children of both groups were assessed by using a general pediatric occupational therapy assessment format as well as new developed tool (FAMC) and GMFM.

2.8. Statistical analysis

Statistical calculations were performed with statistical package for social science (SPSS version 26). Content validity and face validity were assessed by quantitative and qualitative methods. Computed content validity index at item level (I-CVI) and scale level S-CVI) was done by Lawshe's method.¹¹ Reliability and validity of new developed tool was measured. Correlation value (> 0.6 will consider reliable) was calculated from two data sets obtained from Test- retest and inter-ratter method. Coefficient alpha (Cronbach's alpha) was used to assess internal consistency. Coefficient Alpha value is 0.7 or higher was considered as reliable. Correlation analysis between GMFM and FAMC was calculated by using Pearson's correlation test.

3. Results and discussion

Sixty-four items were generated under three stages: Infant (20), Toddler (36) and Preschooler (8). Content validity index (I-CVI) at item level and Scale level (S-CVI) were significantly high (> 0.80) in agreement of Clarity, Essential and Relevancy.

Coefficient alpha (Cronbach's alpha) was used to assess internal consistency.

Value of Cronbach's alpha was 0.98, which is in excellent ($> .90$) category.¹²

Face validity of the tool was evaluated by therapists and parents of CP children. Each item of the tool was under full agreement category (90% - 100%) in formatting, clarity, appropriateness of the item for children with CP.

Test - retest, inter-ratter and concurrent validity of the tool are positively correlated and significantly acceptable.

3.1 FAMC TEST – RETES (CP population) group A

Table 1 Correlation between FAMC Test score and FAMC Re- test score for CP children

Correlations			
		FAMC test	FAMC_Re-test
Famc test	Pearson Correlation	1	0.997**
	Sig. (2-tailed)		0.000
	N	30	30
Famc retest	Pearson Correlation	0.997**	1
	Sig. (2-tailed)	0.000	
	N	30	30

** .Correlation is significant at the 0.01 level (2-tailed).

The above table shows the correlation between FAMC test scores and FAMC retest scores. It is observed that there is strong positive correlation with r value at 0.997. The result is significant with $p < 0.01$ for CP children.

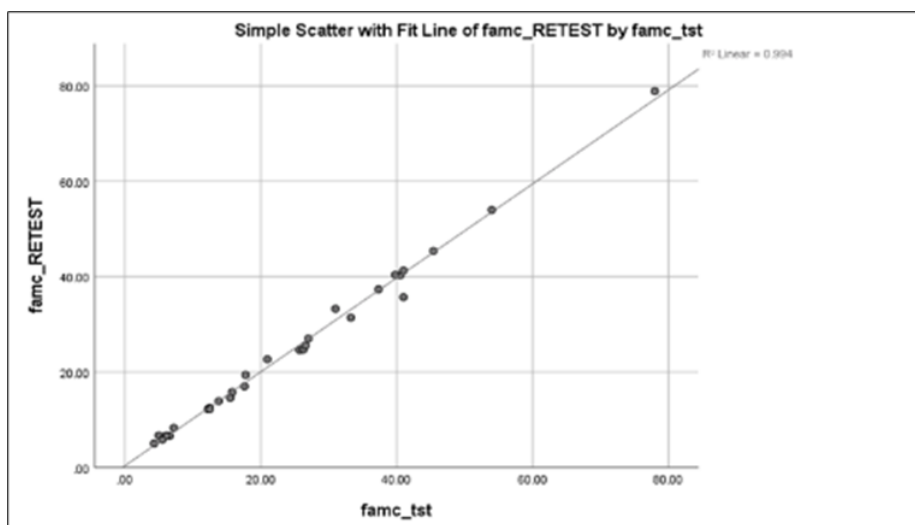


Figure 1 Scatter gram shows a strong positive correlation between FAMC Test scores and FAMC Re-test scores for CP children.

3.2. FAMC TEST- RETEST (normal population) group B

Table 2 Correlation between FAMC Test score and FAMC Re-test score for normal children.

Correlations			
		FAMC_T	FAMC_RT
FAMC_T	Pearson Correlation	1	0.997**
	Sig. (2-tailed)		0.000
	N	30	30
FAMC_RT	Pearson Correlation	0.997**	1
	Sig. (2-tailed)	0.000	
	N	30	30

** .Correlation is significant at the 0.01 level (2-tailed).

The above table shows the correlation between FAMC test scores and FAMC retest scores. It is observed that there is a strong positive correlation with r value at 0.997. The result is significant with $p < 0.01$ for normal children.

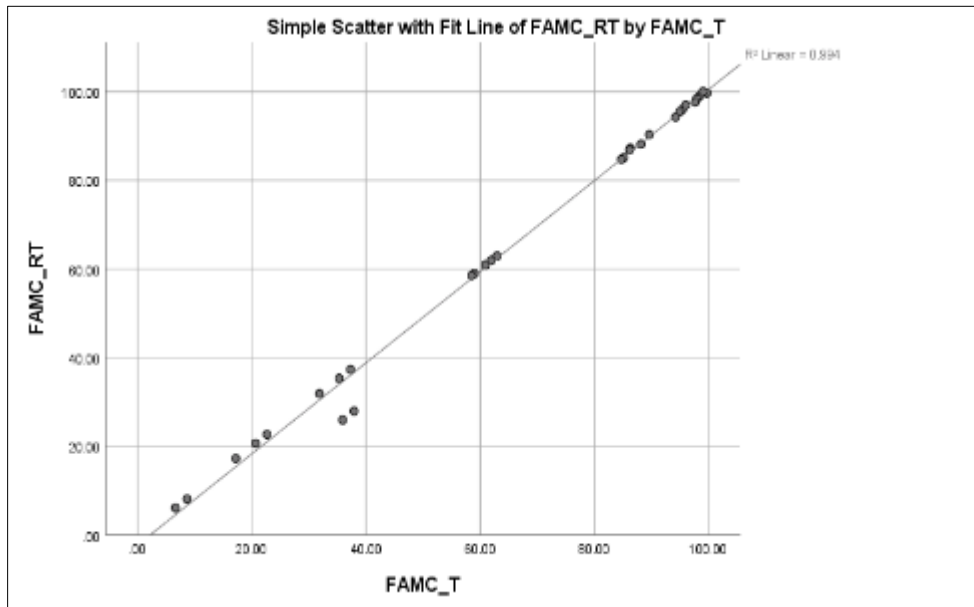


Figure 2 Scatter gram shows a strong positive correlation between FAMC Test scores and FAMC Re-test score for normal children.

3.3 FAMC INTERRATER RELIABILITY (CP population) Group A

Table 3 Correlation between FAMC test scores (principal investigator) and FAMC scores (tested by another rater) for CP children.

Correlations			
		FAMC_AVG	FAMC_IR
FAMC_AVG	Pearson Correlation	1	0.998**
	Sig. (2-tailed)		0.000
	N	30	30
FAMC_IR	Pearson Correlation	0.998**	1
	Sig. (2-tailed)	0.000	
	N	30	30

** . Correlation is significant at the 0.01 level (2-tailed).

The above table shows the correlation between FAMC test scores (principal investigator) and FAMC scores (tested by another rater). It is observed that there is strong positive correlation with r value at 0.998. The result is significant with $p < 0.01$ for CP population.

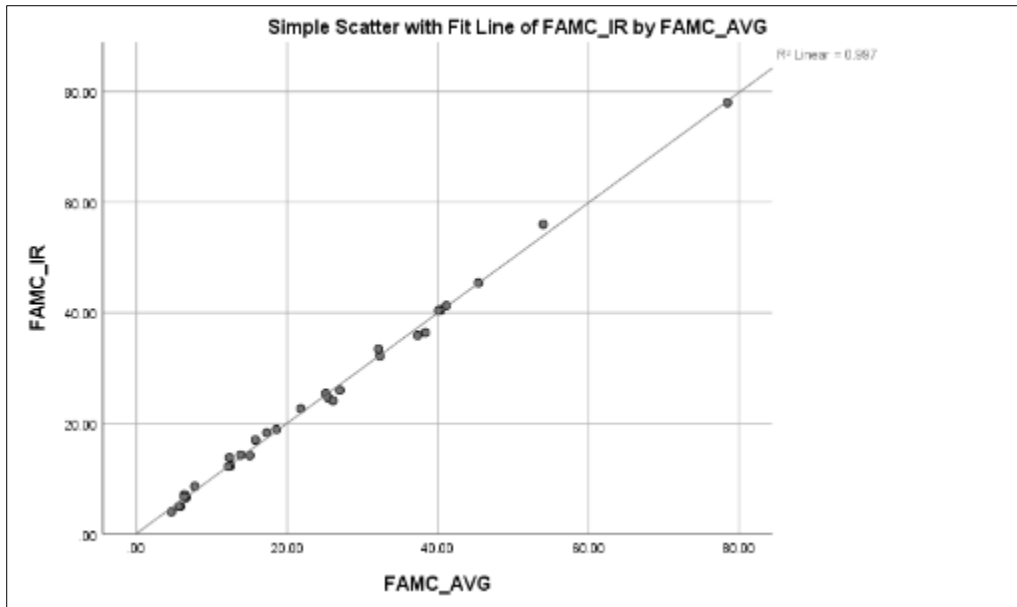


Figure 3 Scatter gram shows a strong positive correlation between FAMC test scores (principal investigator) and FAMC scores (tested by another rater) for CP children.

3.4. FAMC INTERRATER RELIABILITY (normal population) Group B

Table 4 Correlation between FAMC test scores (principal investigator) and FAMC scores (tested by another rater) for normal children.

Correlations			
		FAMC_AVG	FAMC_IRR
FAMC_AVG	Pearson Correlation	1	0.998**
	Sig. (2-tailed)		0.000
	N	30	30
FAMC_IRR	Pearson Correlation	0.998**	1
	Sig. (2-tailed)	0.000	
	N	30	30

** . Correlation is significant at the 0.01 level (2-tailed).

The above table shows the correlation between FAMC test scores (principal investigator) and FAMC scores (tested by another rater). It is observed that there is strong positive correlation with r value at 0.998. The result is significant with $p < 0.01$ for normal population.

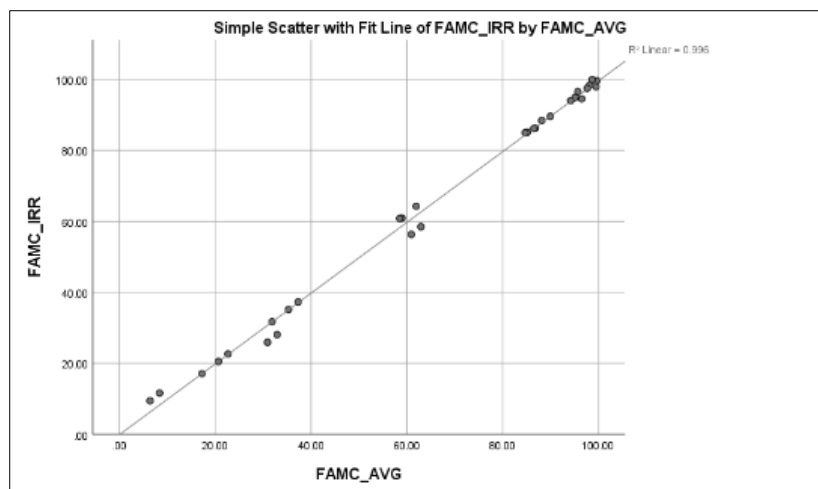


Figure 4 Scatter gram shows the correlation between FAMC test scores (principal investigator) and FAMC scores (tested by another rater) for normal children.

3.5. CONCURRENT VALIDITY (CP population) Group A

Table 5 The correlation between FAMC test scores and GMFM test scores for CP children.

Correlations			
		FAMC_AVG	GMFM_AVG
FAMC_AVG	Pearson Correlation	1	0.821**
	Sig. (2-tailed)		0.000
	N	30	30
GMFM_AVG	Pearson Correlation	0.821**	1
	Sig. (2-tailed)	0.000	
	N	30	30

** . Correlation is significant at the 0.01 level (2-tailed).

The above table shows the correlation between FAMC test scores and GMFM test scores. It is observed that there is strong positive correlation between FAMC test scores and GMFM test scores with r value at 0.821. The result is significant with $p < 0.01$ for CP children.

3.6. CONCURRENT VALIDITY (normal population) Group B

Table 6 The correlation between FAMC test scores and GMFM test scores for normal children.

Correlations			
		FAMC_AVG	GMFM_AVG
FAMC_AVG	Pearson Correlation	1	0.949**
	Sig. (2-tailed)		0.000
	N	30	30
GMFM_AVG	Pearson Correlation	0.949**	1
	Sig. (2-tailed)	0.000	
	N	30	30

** . Correlation is significant at the 0.01 level (2-tailed).

The above table shows the correlation between FAMC test scores and GMFM test scores. It is observed that there is strong positive correlation between FAMC test scores and GMFM test scores with r value at 0.949. The result is significant with $p < 0.01$ for normal population. It is indicating that there is a concurrent validity for FAMC scale for normal children.

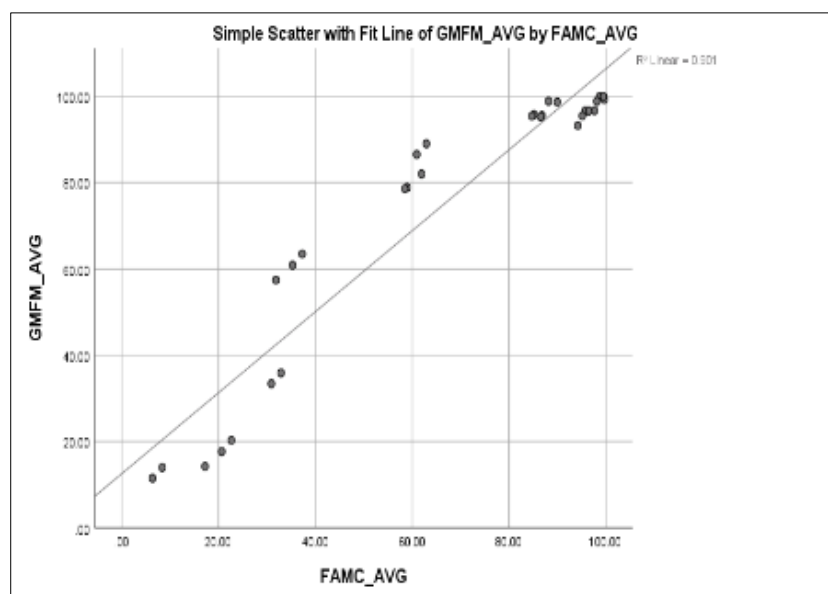


Figure 5 Scatter gram shows the correlation between FAMC test scores and GMFM test scores.

4. Conclusion

Motor development and functional ability for children with cerebral palsy may be considered as an effective tool which is suitable in children with CP. Sample size was small. So, study with a large sample size is recommended.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of ethical approval

The Institutional Ethical Committee of MGUMST (Mahatma Gandhi University of Medical Sciences and Technology) has permitted to conduct the study on "Tool development for analysing Motor Development and Functional Ability for Children with Cerebral Palsy" was held on 19-09-2022. IEC no. MGMC&H/IEC/JPR/2022/910.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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