


The Visual Function Classification System: Translation, Validity, and Reliability of the Persian Version for Individuals with Cerebral Palsy

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ABSTRACT

Objectives: This study aimed to translate and develop the Persian version of The Visual Function Classification System (P-VFCS) while assessing its validity and reliability.

Materials & Methods: The VFCS was created to classify visual function among individuals with Cerebral Palsy (CP). Until this point, no such classification system was available in Iran. Therefore, the VFCS underwent translation into Persian, with the original developer approving the back-translation. A panel of ten occupational therapists and ten parents evaluated the face validity. The Persian version of VFCS (P-VFCS) was administered to 156 participants with CP, aged 1 to 19 years (age range: 2 to 18 years; mean age: 9.1 years; standard deviation: 6.32 years). Inter-rater reliability was measured among 156 parents and four occupational therapists. Test-retest reliability was evaluated throughout two to four weeks with 77 parents and two occupational therapists.

Results: The inter-rater reliability of the weighted kappa between OTs and parents for the P-VFCS was 0.88 (95% confidence interval [CI], 0.62 to 0.89). The weighted kappa test-retest reliability for the P-VFCS was 0.91 (95% CI: 0.93 to 1.00) for occupational therapists and 0.90 (95% CI: 0.89 to 1.00) for parents. The face validity assessment revealed that 80% of parents of individuals with CP (8 out of 10) and 100% of occupational therapists (10 out of 10) found the P-VFCS suitable in translation and face validity quality.

Conclusion: The findings indicated that the P-VFCS is a reliable and valid classification system for classifying visual functions in individuals with CP within clinical settings.

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Introduction

Children with Cerebral Palsy (CP) encounter motor impairments along with developmental and performance challenges, significantly impacted by visual dysfunctions (1). Visual abilities encompass a child's purposeful use of vision to engage with their surroundings. This includes the ability to direct gaze, recognize objects and faces, interact with various elements of the environment, and explore it effectively

(2, 3). Between 50% and 90% of children with CP have ophthalmological issues, including strabismus, refractive errors, and oculomotor dysfunctions (4, 5). Additionally, around 60% to 70% of individuals experience cerebral visual impairment (CVI), occurring due to damage to the visual cortex and visual pathways (6). The severity of these visual complications often correlates with children's motor and cognitive challenges (7). Thus, assessing vision in

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young children with CP is essential for supporting their overall development (8). These visual difficulties can profoundly affect their daily lives and overall quality of life, just as much as the motor disorders they face (9). A growing body of literature has indicated that visual impairments represent a significant concern for many children diagnosed with CP. These visual deficits can profoundly influence various domains of functioning, including gross motor abilities, communication skills, cognitive processes, self-care capabilities, and overall daily functioning (10).

The World Health Organization's International Classification of Functioning, Disability, and Health (ICF) emphasizes the importance of evaluating the functional consequences of all health states (11, 12). Consequently, several classification systems have been developed to describe children's abilities and behaviors rather than merely noting their impairments. These systems include the Gross Motor Function Classification System (GMFCS) (13), the Manual Ability Classification System (MACS) (14), the Communication Function Classification System (CFCS) (15), and the Eating and Drinking Ability Classification System (EDACS) (16).

Measuring visual impairments at the eye or brain level has inherent limitations when identifying functional limitations in daily life. Baranello et al. developed the Visual Function Classification System (VFCS) to address this issue. The VFCS focuses on usual performance rather than best capacity, categorizing individuals into five levels based on their effectiveness and frequency of using visual functions in various activities. It considers the environments in which vision is utilized, the necessity for assistance, and the reliance on other sensory modalities for vision-related tasks. Parents, caregivers, and professionals can employ this classification system, including healthcare providers, educators, and rehabilitation specialists who work with children with CP (9).

Recognizing the significance of this classification system and the lack of a Persian version, this study seeks to translate and evaluate the reliability and validity of the P-VFCS for individuals with CP aged 1 to 19 years in Iran.

Materials & Methods

Visual Function Classification Scale (VFCS) is a 5-level classification system for 1 to 19-year-old individuals with CP that describes how children with CP use visual functions in daily activities. The VFCS highlights functional abilities instead of limitations. In this system, Level I signifies high visual function, while Level V represents the lowest level of visual function (9). VFCS is a valid and reliable classification system that describes how children with CP use

customary visual functions. The VFCS does not explain the underlying reasons for the visual function abilities. It highlights functional abilities rather than limitations. The goal of VFCS was to include vision into the system of existing classifications for individuals with CP.

The VFCS describes the usual daily performance of a person with CP rather than his or her best capacity. That is why it is essential to think about daily situations in a typical environment when classifying the level of visual function by the system. The lowest level (I, uses visual function easily and successfully) corresponds to better functioning, and the highest level (V, does not use visual function even in very adapted environments) corresponds to worst functioning. The classification could be completed by anyone familiar with the child's visual function abilities, including a parent or caregiver, physician or occupational therapists, or the individual themselves, and does not need the cooperation of children (9). The interrater reliability of its original version, including 29 professionals, 39 parents, and a total sample of 160 children with CP (age range 1-19), was 86% (weighted $\kappa=0.88$; 95% confidence interval [CI] 0.83–0.93). Although the parent-professional interrater reliability of 39 children was moderate (weighted $j=0.51$; 95% CI 0.39-0.63). The test-retest reliability was high (weighted $\kappa=0.97$; 95% CI 0.95-0.99).

In the present study, the sample size was consistent with psychometric studies on classification systems, and accordingly, the sample size for reliability assessment was 160 individuals with CP (8); in the present study, the samples were selected from rehabilitation clinics in Tehran, Iran, using accessible methods.

In this study, the development of the P-VFCS occurred in two phases. The first phase involved translating and adapting the content for cultural relevance. The second phase focused on evaluating face validity, inter-rater reliability among professionals and parents, and the adapted version's test-retest reliability, ensuring its validity and reliability for diverse settings.

Translation

According to the International Quality of Life Assessment (IQOLA) method, the first stage of forward translation involved two native Persian translators who were fluent in English and translated the original version of the VFCS. These translations were then reviewed and synthesized by experts and individuals with experience in CP, resulting in a finalized Persian version. In the second stage, known as backward translation, another native Persian translator, fluent in English, re-translated the Persian

version back into English. This re-translated version was subsequently subjected to expert review for finalization. In the third stage, the translated VFCS was submitted for approval to the developer, Baranello. Following the developer’s post-approval of the translated version, assessments were conducted to evaluate the face validity, as well as the reliability of the translated version.

Face Validity

Face validity was evaluated by ten parents of children with CP and ten occupational therapists. Each therapist had at least two months (eight weeks) of comprehensive experience working with children with CP and was thoroughly familiar with children, specifically with their visual function. Feedback on the clarity and simplicity of the questionnaire was collected using a 3-point Likert scale, with the options being “yes,” “somewhat,” and “no.”

Table 1: Characteristics of individuals with CP (n = 156) in the reliability phase

Characteristic	Frequency	Percent
VFCS level		
I	21	13.46
II	27	17.31
III	54	34.61
IV	33	21.15
V	21	13.46
GMFCS level		
I	28	17.95
II	29	18.59
III	51	32.69
IV	30	19.23
V	18	11.54
MACS level		
I	33	21.15
II	34	21.79
III	45	28.85
IV	24	15.38
V	20	12.82
CFCS level		
I	13	8.33
II	25	16.02
III	76	48.72
IV	27	17.31
V	15	9.61
Type of CP		
Spastic Hemiplegia	35	22.43
Spastic Diplegia	57	36.54
Spastic Quadriplegia	39	25
Ataxia	11	7.05
Athetoid	14	8.97

VFCS; Visual Function Classification System. **GMFCS:** Gross Motor Function Classification System. **MACS;** Manual Ability Classification System. **CFCS;** Communication Function Classification System. **CP;** Cerebral Palsy.

Inter-rater and test-retest reliability

To assess inter-rater reliability, four occupational therapists and 156 parents of individuals with CP classified individuals’ visual function (age, 2 to 18 years; mean age, 9.1±6.32 years) based on the P-VFCS. Two occupational therapists and 77 parents of children with CP assessed test-retest reliability after re-completing the P-VFCS at two different points in time, with an average interval of three weeks (2-4 weeks).

Statistical analysis

The study’s results were analyzed using SPSS version 26. Prior to the primary analyses, the normality

of the research variables was checked with the Kolmogorov-Smirnov test. This test confirmed that the research variables met the normality assumption ($P < 0.005$).

Weighted kappa analysis was employed to assess both inter-rater reliability and test-retest reliability. A significance level of $P \leq 0.05$ was established. A kappa value of 0.7 is recommended as the minimum standard for reliability. Values greater than 0.75 indicate excellent agreement, values less than 0.40 suggest poor agreement, and values between 0.40 and 0.75 reflect fair to good agreement (18).

Results

The average age of the participants in this study was 9.1 ± 6.32 years, with a minimum age of two years and a maximum age of 18 years; 56% of the participants were female. The average age of the parents was 34.5 ± 3.11 years. Additional demographic information regarding the participants is indicated in Table 1.

Translation

The back translation was emailed to Mr. Baranello, an Italian pediatric neurologist and the original developer of VFCS, who approved the translated version. It was published simultaneously in various languages on the VFCS website (<https://www.pisasmilelab.it/vfcs>).

The face validity assessment revealed that 80% of parents of individuals with CP (8 out of 10) and 100% of occupational therapists (10 out of 10) found the P-VFCS suitable in translation quality. This classification

system was comprehensible and practical for evaluating the visual function of individuals with CP in the Iranian community, with no significant issues in understanding the items.

Inter-rater and test-retest reliability

Inter-rater reliability was found to be excellent between occupational therapists and parents. Parents and OTs separately classified the visual function of 156 individuals with CP. The inter-rater reliability of the weighted kappa between OTs and parents was 0.88 (95% confidence interval [CI], 0.62 to 0.83). The results of the inter-rater reliability are demonstrated in Table 2.

The weighted kappa test-retest reliability for 77 individuals with CP was 0.91 (95% CI: 0.93 to 1.00) for occupational therapists and 0.90 (95% CI: 0.89 to 1.00) for parents. The results of the test-retest are shown in Table 3.

Table 2: Inter-Rater Reliability of the P-VFCS

The weighted kappa inter-rater reliability among **OTs** and **parents** for the 156 classified individuals with CP was 0.88 (95% CI :0.62- 0.89)

OTs	Parents					Total
	I	II	III	IV	V	
I	38*		2	1		41
II	2	28*	1	1	1	33
III			30*	2		32
IV	1			19*	1	21
V			1	2	26*	29
Total	41	28	34	25	28	156

*: shows exact agreement between the two raters

OT, Occupational Therapists

Discussion

The importance of visual abilities in children with CP has been well-documented in numerous studies (1, 2, and 10). While some children with CP may face visual impairments that hinder their performance and limit participation in daily activities, for others, visual ability may serve as a notable strength (3). Consequently, the assessment of visual impairments is crucial for the effective management of individuals with CP. However, it is essential to recognize that such assessments may not fully capture the broader impacts on daily life and overall daily functioning (10).

Similar to classification systems such as the GMFCS, MACS, CFCS, and EDACS, the VFCS was not developed as an assessment instrument and does not aim to elucidate the underlying factors influencing a child's visual functioning (8). Within the framework of the International Classification of Functioning, Disability, and Health (ICF), it is recognized that disability levels are influenced by various factors, including comorbidities such as intellectual disabilities,

behavioral challenges, and environmental barriers to care and resources (12).

Recent advancements have led to translating and validating the GMFCS, MACS, CFCS, and EDACS into Farsi, enhancing their utility for assessing individuals with CP in Iranian clinical settings. Recognizing the critical role of visual function in the daily activities and participation of individuals with CP, creating a culturally and linguistically adapted instrument for classifying visual function is imperative.

In this study, the VFCS, grounded in the ICF framework, was adapted and validated for Farsi-speaking individuals with CP to address this need. The psychometric evaluation of the P-VFCS confirmed its validity and reliability in classifying the visual function of Iranian individuals with CP, demonstrating properties consistent with the original version. This adaptation represents a significant step forward in providing comprehensive and accurate assessments tailored to the needs of this population.

A critical aspect of this study was the translation process, which, with a face validity of 80% between parents and 100% between occupational therapists, ensured the cultural and linguistic appropriateness of the VFCS for Iranian families. By adopting a culturally sensitive approach, the accessibility and relevance of the classification system were enhanced, thereby fostering effective communication between families and healthcare professionals. This approach also encouraged greater engagement in assessment and intervention processes.

Establishing a shared framework for caregivers and occupational therapists is necessary to communicate about individuals with CP, making the classification concept easy to understand (19, 20). This study's results demonstrated robust psychometric properties of the P-VFCS, with excellent inter-rater and test-retest reliability performed in a 2-4 weeks interval, the same as the original version, among occupational therapists and parents.

Table 3: Test-Retest Reliability of the P-VFCS

Test-retest reliability by OTs for 77 individuals with CP (weighted kappa) is 0.91 (95% CI, 0.93-1.00)						
Time 1 OTs	Time 2 OTs					Total
	I	II	III	IV	V	
I	14*		2			16
II		19*	1			20
III			14*			14
IV			1	11*	1	13
V		1			13*	29
Total	14	20	18	11	14	77

Test-retest reliability by parents for 77 individuals with CP (weighted kappa) is 0.90 (95% CI, 0.89-1.00)						
Time1 Parents	Time2 Parents					Total
	I	II	III	IV	V	
I	13*	1	2			16
II		20*				20
III			14*			14
IV				12*	1	13
V		1			13*	14
Total	13	22	14	12	14	77

* : shows exact agreement between the two times of classifying

In terms of reliability, the weighted kappa for interrater reliability represented excellent agreement (0.88), and the weighted kappa for test-retest reliability between occupational therapists (0.91) and occupational therapists and parents (0.90) also indicated excellent agreement. These findings underscore the reliability of the P-VFCS in producing consistent outcomes across evaluators and, over time, reinforcing its clinical utility. This reliability is particularly significant for healthcare providers as it ensures the classification system's dependability in accurately classifying a child's visual functional abilities.

Comparing the P-VFCS to its Italian (9), Turkish (8), and Japanese (21) counterparts further highlights its robustness. In the original Italian version of the VFCS, absolute interrater agreement among professionals was excellent (86%; weighted $\kappa = 0.88$; 95% CI: 0.83–0.93), alongside excellent test-retest reliability (weighted $\kappa = 0.97$; 95% CI: 0.95–0.99). Notably, parent-professional interrater reliability was moderate (weighted $\kappa = 0.51$; 95% CI: 0.39–0.63). This finding suggests that while the classification tool was effective among

professionals, aligning parents and professionals in the Italian context posed specific challenges (9).

The Turkish VFCS also exhibited good interrater reliability between physiotherapists and caregivers (ICC = 0.866, ICC = 0.893) and excellent test-retest reliability (e.g., ICC = 0.971; CI = 0.958–0.979). These results highlight the adaptability of the VFCS to a culturally distinct population, with caregivers playing a significant role in the evaluation process (8).

Similarly, the Japanese version demonstrated good interrater reliability (Cohen's $\kappa = 0.67$; 95% CI: 0.56–0.78) and reported relatively lower values than the Italian and Turkish versions. Although previous studies reported good parent-professional reliability, this study revealed excellent interrater reliability between professionals and parents, underscoring the robustness and utility of the P-VFCS (21).

This study's enhancement in parent-professional reliability may be attributed to improved communication and collaboration between these groups, leading to a clearer understanding of assessment criteria. Additionally, targeted training for

both parents and professionals likely played a key role in achieving this higher level of reliability. These findings emphasize the value of incorporating parental insights during the evaluation process, as they provide critical perspectives that enrich the understanding of a child's development and needs.

The original VFCS identified challenges in accurately classifying VFCS for individuals with CP at GMFCS Levels IV and V. However, the current study's findings demonstrate that the P-VFCS provides reliable classifications for individuals within these groups.

The P-VFCS can be a valuable tool for pediatric neurologists, pediatric orthopedic specialists, and occupational therapists working with individuals with CP. Occupational therapists are often among the first professionals to evaluate motor function in children with CP, and they play a pivotal role in detecting visual impairments during developmental assessments (8). The assessment of disorders is inherently systematic and time-intensive. By classifying and organizing patterns of visual function, practitioners can better understand the condition's nature and ensure precise communication of findings within the scientific and clinical communities (9). This, in turn, facilitates the implementation of informed clinical decisions and promotes more effective interventions. Utilizing classification systems that incorporate input from both families and professionals offers a comprehensive approach to identifying visual challenges in the context of daily functioning, ultimately enhancing care for individuals with CP.

In Conclusion

The current study demonstrated that the P-VFCS exhibits strong reliability and validity for individuals

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with CP. This adaptation is crucial for addressing the unique communication challenges faced by this population. By using the P-VFCS in clinical settings, healthcare professionals can effectively enhance understanding and tailor interventions.

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The research received approval from the Ethics Committee at Shahid Beheshti University of Medical Sciences in Iran under the code of ethics IR.SBMU.RETECH.REC.1402.101. Before participation, all parents and therapists provided their written informed consent.

Authors' Contribution

Marzieh Pashmdarfard, Minoos Kalantari and Malek Amini: Study concept and design. Sara Zamiran, Marzieh Pashmdarfard and Malek Amini: Acquisition of data. Alireza Akbarzadeh Baghban and Giovanni Baranello: Analysis and interpretation of data. Sara Zamiran and Marzieh Pashmdarfard: Drafting of the manuscript. Minoos Kalantari and Malek Amini: Editing the manuscript. All authors agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Conflict of Interest

None

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