



# Effects of visual perception and motor function on the activities of daily living in children with disabilities

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## Research Article

**Purpose:** Our study was designed to examine the impact of visual perception and motor functions on the activities of daily living in children with disabilities. **Methods:** Thirty-five children with mild mental retardation between 5 and 17 years of age were recruited for the study. Activities of daily living were evaluated using the Functional Independence Measure (WeeFIM), visual perception was evaluated using the Motor-Free Visual Perception Test (MVPT-3), and motor function was assessed using the Gross Motor Function Measure (GMFM). **Results:** Positive correlations were found between GMFM score and total WeeFIM score ( $r=0.467$ ) and sub-tests of WeeFIM including self-care ( $r=0.513$ ), mobility ( $r=0.658$ ), and locomotion ( $r=0.453$ ) scores ( $p<0.05$ ). Visual memory and visual closure and total scores of MVPT-3 were significantly related with WeeFIM total score ( $r=0.440$ ,  $r=0.504$ , and  $r=0.338$ ,  $p<0.05$ , respectively). Visual discrimination of MVPT-3 was significantly associated with self-care of WeeFIM ( $r=0.346$ ,  $p<0.05$ ). **Conclusion:** Sub-parameters of the visual perception were found to be important factors for independency in activities of daily living of children with disabilities. Selection of these kinds of tests provide information about evaluation of the level of the child's motor development, and also which tests should be selected to evaluate both upper and lower extremity motor function.

**Key words:** Visual perception, Activities of daily living, Motor function, Mental retardation, Child.

## Engelli çocuklarda görsel algı ve motor fonksiyonların günlük yaşam aktiviteleri üzerine etkisi

**Amaç:** Çalışmamız, hafif zihinsel engelli çocuklarda görsel algılama ve motor fonksiyonların günlük yaşam aktiviteleri üzerine olan etkisini incelemek amacıyla planlandı. **Yöntem:** Çalışmaya yaşları 5-17 yıl arasında değişen 35 hafif zihinsel engelli gönüllü çocuk alındı. Çocukların günlük yaşam aktivitelerini değerlendirmek için Fonksiyonel Bağımsızlık Ölçeği (WeeFIM), görsel algılarını değerlendirmek için Motor Yetenek Olmaksızın Görsel Algılama Testi (MVPT-3) ve motor fonksiyonları değerlendirmek için Kaba Motor Fonksiyon Ölçüm (GMFM) değerlendirmeleri yapıldı. **Sonuçlar:** Çocukların GMFM puanı ile toplam WeeFIM ( $r=0.467$ ) ve WeeFIM'in alt testlerinden kendine bakım ( $r=0.513$ ), mobilite ( $r=0.658$ ), lokomasyon ( $r=0.453$ ) arasında pozitif yönde korelasyon bulundu ( $p<0.05$ ). Görsel hafıza puanı, görsel yakınlık 2 puanı ve MVPT-3 toplam puanı WeeFIM toplam puanı ile ilişkiliydi (sırasıyla,  $r=0.440$ ,  $r=0.504$  ve  $r=0.338$ ,  $p<0.05$ ). MVPT-3 görsel ayırım puanı WeeFIM kendine bakım puanı ile anlamlı ilişki gösterdi ( $r=0.346$ ,  $p<0.05$ ). **Tartışma:** Çocukların görsel algılamanın alt parametrelerinden olan görsel hafıza, görsel yakınlık ve görsel ayırımın, bu çocukların günlük yaşam aktivitelerindeki bağımsızlıklarında önemli bir etken olduğu görüldü. Bu tür değerlendirmeye ait testlerin seçiminde çocuğun hangi motor gelişim seviyesinde olduğunun yanı sıra hem üst hem de alt ekstremitenin motor fonksiyonlarını değerlendiren testlerin seçimi açısından bilgi vermektedir.

**Anahtar Kelimeler:** Görsel algı, Günlük yaşam aktiviteleri, Motor fonksiyon, Mental retardasyon, Çocuk.

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Motor function can be affected from cognitive, visual, vestibular and proprioceptive stimulants, and aiming to maximize motor, functional, intellectual and social context, and ensure independency of the child to minimize the disability<sup>1</sup>. Gross and fine motor function, perception and cognitive status, personal and social function, and existing functional status of the child should be evaluated when organizing rehabilitation programs to achieve predetermined target<sup>2</sup>.

Motor skills of children significantly changes during childhood. This situation affects the performance of daily living<sup>3-5</sup>. Information about typically developing children's improvements in activities of daily living (ADL) is still being discussed in the studies<sup>6-10</sup>.

The concept of ADL is described as routine and daily activities necessary to live, and separated into two headings as the "Basic ADL" and "instrumental or advanced ADL". Basic ADL includes activities such as self-care, eating, dressing, and hygiene. Pediatric functional outcome measures are also related to these parameters, and completed parts of these functions are saved. Instrumental or advanced ADL involves higher-level tasks such as cooking, money management, housekeeping, shopping, telephone use, and social and communicative activities<sup>11</sup>. Sensory, perceptual, motor and cognitive skills are all important as a whole in achieving ADL. For example, from detection to matching and dressing clothes independently is an ongoing activity of complex acts. Perception of visual clues when performing the sections is also very important.

Visual perception provides connection to our environment. Its development is provided by a combination of perception of visuals stimuli, orientation of the head and eyes, and dominant visual clues, starting from birth. Perception is increased by experience and application over time, with the stimuli coming from the environment. These visual warnings play an important role to continue our daily lives<sup>12</sup>. We use lots of parameters of visual perceptions in ADL such as space visualization to locate the items, figure-

ground perception to understand the difference between a plate and a table cloth while eating, visual discrimination for matching pairs of shoes.

Disabled children experience difficulties in some parameters of visual-motor-perception integrity due to their different brain lesions. These challenges may affect the children negatively to perform their ADL. While studies exist in children with cerebral palsy and coordination problems, which are investigating the relationship between these disorders and visual perception and/or motor functions, studies which are evaluating the effect of these disorders on ADL are not found. Therefore, our study was designed to examine the effects of visual perception and motor functions on the ADL in children with disabilities.

## METHODS

### Participants:

Thirty five children between 5 and 17 years of age were recruited for the study. Children were included in the study in accordance with the diagnoses specified in the medical board reports received from a full-fledged hospital

The mental disability levels of children were mild according to health board reports and their cooperation was observed to be sufficient in all assessments. Children's and their families' consent was taken before the study. Individuals did not have refractive errors, and all of them are ambulatory except some balance and coordination problems. There was no concomitant problem at the time of the assessment.

### Tests:

The Functional Independence Measure (WeeFIM) was used to evaluate ADL. The Motor-Free Visual Perception Test (MVPT-3) was used for the assessment of visual perception, and the Gross Motor Function Measure (GMFM) and Gross Motor Function Classification System (GMFCS) were used for determining the motor function and their levels.

The WeeFIM is a method which has validity and reliability (ICC=0.91-0.98) in children (between 6 months and 12 years) with disabilities such as Down syndrome, spina bifida, absence of

extremities, and prematurity. It includes a total of 18 items in six areas as self-care, sphincter control, transfers, locomotion, communication, and social and cognition. Depending on the amount of assistance given, 1 to 7 points are given<sup>13-14</sup>.

The MVPT-3 is a valid and reliable test (ICC=0.74) consisting of a 65 questions under various sub-headings such as visual memory, visual discrimination and figure ground. It is used in individuals between the ages of 4 to 90<sup>15</sup>. It is also used in children with developmental diseases such as cerebral palsy<sup>16-17</sup>. Both sub-parameters and total scores were used for the evaluation<sup>18</sup>.

The GMFM is a measure of gross motor function in children between the 15 months to 13 years of age, and the criteria used to demonstrate the changes in these functions as references. It was reported to be a valid, reliable and sensitive method as much as video-tape recordings for demonstrating the changes in motor functions, i.e. the effectiveness of treatment, in children with cerebral palsy and other disabilities<sup>19-22</sup>.

The GMFCS examines the levels of gross motor functions in the individuals in 5 different levels (ICC=0.99). It is used for the individuals between 0 and 18 years of age. Level 1 shows the disabilities in very advanced motor skills, and level 5 defines the severe functional deficiency even in the presence of assistive device or equipment<sup>23</sup>.

### Statistical analysis:

Pearson correlation analysis was used to evaluate the relationships between the ADL, and visual perception and motor functions. The difference between two means was provided with a 95% confidence interval ( $p < 0.05$ ).

## RESULTS

Thirty-five communicable children with a mean age of  $12.23 \pm 3.8$  years (18 males, and 17 females) and with a diagnosis of motor mental retardation were included in the study. All of the children were with mental retardation in mild level, and the average IQ of children was  $64.28 \pm 14.62$ .

The mean of total scores of WeeFIM was

found to be  $115.40 \pm 15.07$  (range 67-134). The mean WeeFIM self care score was  $39.62 \pm 2.34$ , transfers was  $21.00 \pm 0.00$ , social and cognition was  $16.87 \pm 1.25$ , sphincter control was  $14.00 \pm 0.00$ , locomotion was  $12.00 \pm 0.00$ , and communication was  $11.87 \pm 1.65$ . The mean total MVPT-3 score was  $26.62 \pm 10.12$  (range 10-53). The mean MVPT-3 visual discrimination score was  $6.45 \pm 2.29$ , visual closure score was  $5.34 \pm 2.31$ , visual short term memory was  $4.31 \pm 2.08$ , form constancy score was  $4.05 \pm 1.32$ , visual differentiation score was  $3.66 \pm 1.97$ , visual closure-I score was  $2.00 \pm 1.26$ , visual closure-II score was  $1.76 \pm 0.83$ , figure ground was  $1.33 \pm 0.85$ , and spatial orientation score was  $1.19 \pm 1.32$ .

The correlations between the MVPT-3 and WeeFIM were demonstrated in Table 1. Visual memory and visual closure and total scores of MVPT-3 were significantly related with WeeFIM total score ( $r=0.440$ ,  $r=0.504$ , and  $r=0.338$ ,  $p < 0.05$ , respectively, Table 1). Visual discrimination of MVPT-3 was significantly associated with self-care of WeeFIM ( $r=0.346$ ,  $p < 0.05$ , Table 1).

Three of the cases were found to be in level 1, and the remaining was in level 2 according to the GMFCS. The mean GMFM score was  $92.56 \pm 8.28$ . The evaluation of GMFM scores for the first four fields revealed full in almost all of the children whereas the differences were found to be in walking-running-jumping section. Positive correlations were found between GMFM score and total WeeFIM score ( $r=0.467$ ) and sub-tests of WeeFIM including were self-care ( $r=0.513$ ), mobility ( $r=0.658$ ), and locomotion ( $r=0.453$ ) scores ( $p < 0.05$ ) (Table 2).

## DISCUSSION

Visual perception was found to affect ADL in our study. The relationships between MVPT-3 and total scores of WeeFIM, visual discrimination and self-care, and visual memory and total scores of ADL informed us about how the individuals organize their activities in the field of self-care as eating, care, bathing, dressing and toilet activities

**Table 1. The relationship between Motor-Free Visual Perception Test (MVPT-3) and Functional Independence Measure (WeeFIM) scores.**

MVPT-3	WeeFIM							
	Self care		Mobility		Locomotion		Total Score	
	r	p	r	p	r	p	r	p
Visual discrimination	0.346	0.042*	-0.097	0.581	-0.095	0.587	0.254	0.141
Form constancy	0.225	0.193	-0.032	0.855	-0.027	0.877	0.142	0.416
Visual STM	0.259	0.134	0.016	0.926	0.123	0.483	0.440	0.008*
Visual closure	0.131	0.453	-0.007	0.967	0.060	0.731	0.281	0.101
Visual differentiation	0.185	0.303	0.041	0.819	0.143	0.429	0.312	0.077
Spatial orientation	-0.205	0.373	-0.034	0.884	-0.345	0.125	-0.165	0.476
Figure ground	-0.038	0.870	-0.122	0.598	-0.025	0.913	-0.170	0.462
Visual closure-I	0.418	0.060	0.331	0.143	0.206	0.371	0.504	0.020*
Visual closure-II	-0.085	0.713	-0.342	0.130	-0.015	0.949	-0.124	0.591
MVPT total score	0.317	0.063	-0.017	0.924	0.031	0.859	0.338	0.047*

\* p<0.05. STM: short term memory.

**Table 2. The relationship between Gross Motor Function Measure (GMFM) and Functional Independence Measure (WeeFIM) scores.**

GMFM	WeeFIM							
	Self care		Mobility		Locomotion		Total Score	
	r	p	r	p	r	p	r	p
Standing	0.279	0.104	0.378	0.025*	0.138	0.428	0.273	0.113
Walking	0.562	<0.001	0.738	<0.001	0.568	<0.001	0.512	0.002*
Climbing stairs	0.262	0.129	0.266	0.123	0.187	0.262	0.192	0.269
Total score	0.513	0.020*	0.658	<0.001	0.453	0.060	0.467	0.049*

\* p<0.05.

by visual discrimination and how they discriminate the objects. The total scores of both tests show the importance of effect of visual perception on ADL, and the importance of information collected in visual memory on performing the ADL.

Visual perception contributes to the development of many other important functions such as motor functions and positions of objects in space<sup>24,25</sup>. Individuals require many parameters of visual perception for performing the ADL. While studies exist in children with cerebral palsy

and coordination problems, which are investigating the relationship between these disorders and visual perception and/or motor functions<sup>26,27</sup>, there is lack a study evaluating the effect of these disorders on ADL.

Spatial orientation, figure ground, visual differentiation, and visual memory were all thought to be important in localizing the items used in ADL, but no positive correlations were found between them and any of the ADL in our study. This finding may be the results of our cases were at least minimally mentally affected. In

addition, the most important indicator of the independence in ADL is not only the visual perception but also other parameters affecting this performance such as proprioception and praxis. Using both tests together will provide important clues about rehabilitation by completing each other.

Many neurodevelopmental treatment methods are used in the treatment of disabled children<sup>28</sup>. GMFM is commonly used for evaluating the effectiveness of these treatments on motor performance, and WeeFIM is used to evaluate ADL<sup>15,29,30</sup>. Wong and colleagues investigated correlation between risk factors and functional independence using WeeFIM in children with cerebral palsy. They found that these children have some motor disorders, but most of them were independent when their functionalities were assessed<sup>31</sup>. Not only the motor functions but also the ADL need to be determined in these children both before and after the treatment to observe the effectiveness of treatment approaches. Similarly, our study revealed that use of both tests together for the evaluation provided comprehensive results.

Palisano and colleagues found that a child is more functional in the presence of higher GMFM scores in their study of 585 children with cerebral palsy between 2 to 12 years of age<sup>32</sup>. Ketelaar et al. examined the effects of functional therapy on motor performance in children with cerebral palsy. They applied functional physiotherapy in one group, and movement quality correcting therapy to the other group. They used self-care and mobility items of Pediatric Evaluation of Disability Inventory and GMFM for the evaluation. They found that GMFM scores increased in the group receiving functional physiotherapy, and their functional skills in daily life found to be developed after the treatment<sup>33</sup>. In the same study, GMFM assessments were found to be more common in clinical settings, whereas Pediatric Evaluation of Disability Inventory was applied more in daily life environment according to the information received from the families. Similarly, the WeeFIM used in this study has been completed in

accordance with the information received from the family. Additionally, WeeFIM was found to be strongly correlated with self-care, mobility, and locomotion which are associated with fine and gross motor functions. This finding showed that progress in motor function increases level of independence during ADL. The children included in our study were at the level 1 and level 2 of GMFCS and this condition may be responsible from the strong relationship between these two parameters. Additionally, strong correlations between walking and self-care, mobility, locomotion, and total scores of WeeFIM were thought to be due to inclusion of similar items in both tests. In addition, absence of correlations between skills of climbing stairs and self-care, mobility, and locomotion was thought to be caused by different evaluation environments in two tests.

Not having a control group consisting of healthy children for comparison is a limitation of this study is having no control group for comparison. We also did not investigate the relationship between mental status and the ADL. Since our study was designed to examine the impact of visual perception and motor functions on ADL in children with disabilities, further studies are needed to address these issues for the children with disabilities.

In conclusion, visual perception was found to be an important factor in the independence during ADL in children with mental and motor disabilities. We thought that our study would contribute literature in terms of findings examination of visual perception and motor functions during ADL in children with disabilities. It may also guide to the inclusion of motor and visual perception in the planning of ergotherapy and physiotherapy programs to increase independency in ADL according to individual needs.

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