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Evaluation of the Family-Rated Kinder Infant Development Scale (KIDS) for Disabled Children

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ABSTRACT

Background : Our objective was to test the validity and reliability of the Kinder Infant Development Scale (KIDS) rated by families of patients.

Methods : Eleven children with disabilities (aged 0.92 to 3.92 y ; 6 males, 5 females) participated in this prospective study. To prove the validity and reliability of the family-rated KIDS, KIDS was administered to inpatient subjects by their families and by an occupational therapist at our hospital. Age, diagnosis, and results of the staff-rated Functional Independence Measure for Children (WeeFIM) and of the staff-rated Enjoji Scale of Infant Analytical Development (ESID) were recorded.

Results : The scores on the 9 subscales of the family-rated KIDS and staff-rated KIDS had appropriate internal consistency (Cronbach's α=0.981, 0.982). Interrater reliability analysis indicated almost perfect reliability of the following KIDS subscales : "physical motor," "manipulation," "receptive language," "expressive language," "language concepts," "social relationships with children," "social relationships with adults," "discipline," and "feeding" (intraclass correlation coefficient=0.944-0.997). The developmental age assessed with KIDS was correlated with the total scores on the motor and cognitive WeeFIM and with the developmental age on ESID (r=0.659-0.841, $p<0.05$).

Conclusions : This study provides evidence for the validity and reliability of the family-rated KIDS for assessing the developmental age and functional ability of disabled children.

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Key words : children with disability, Kinder Infant Development Scale (KIDS), rehabilitation, functional ability

INTRODUCTION

The Kinder Infant Development Scale (KIDS), which was developed by the Center of Developmental Education and Research in Japan, is convenient and easy to use and can be easily administered by parents. This test was standardized in 1988 and 1989 using 6,000 children aged 0 to 6 years[1]. However, no study has evaluated the validity and reliability of the family-rated KIDS in disabled children. The objective of this pilot study was to test the validity of the family-rated KIDS by assessing the relationship between the family-rated KIDS score and the scores for activities of daily life as assessed by the Functional Independence Measure for Children (WeeFIM) and the Enjoji Scale of Infant Analytical Development (ESID) at the time of a medical examination by an occupational therapist.

In 1987, the Functional Independence Measure (FIM) was adapted for use in pediatric patients by a multidisciplinary team of physicians, nurses, and therapists[2]. The resulting scale, known as WeeFIM, is a measure of functional abilities and the need for assistance that is associated with various levels of disability in children aged 6 months to

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7 years. It can also be used in children much older than 7 years if delays in functional performance are evident. The WeeFIM is most widely used in the field of pediatric rehabilitation medicine. The ESID is the most well-known scale for evaluating the developmental age of children. Therefore, in assessing the validity of the family-rated KIDS, we determined whether the results of the family-rated KIDS, the staff-rated KIDS, the ESID, and the WeeFIM were comparable.

STUDY POPULATION AND METHODS

In July 2011, 11 children with motor impairment or cognitive impairment or both began inpatient occupational therapy at the National Center for Child Health and Development. The patients were 6 boys and 5 girls with a median age of 2.00 years (range, 0.92 to 3.92 years). The diagnoses were, in 2 patients, double-outlet right ventricle, and in 1 patient each, cerebral palsy, traumatic brain injury, chromosomal abnormality, Pierre Robin syndrome, pervasive developmental disorders, mental retardation, cloverleaf skull, osteogenesis imperfecta, and nephrotic syndrome. All patients had some delay in motor development or cognitive development or both. Before the study, the parents of the patients gave informed consent to participate in this research study.

Tests

Following admission, all subjects underwent examination in preparation for rehabilitation. The examination included assessments of physical and mental developmental ages with the KIDS Type T, of developmental age with the ESID, and of functional abilities with the WeeFIM.

The KIDS type T consists of a list of behaviors in the following 9 subscales : "physical motor" (37 behaviors), "manipulation" (37 behaviors), "receptive language" (37 behaviors), "expressive language" (37 behaviors), "language concepts" (25 behaviors), "social relationships with children" (25 behaviors), "social relationships with adults" (37 behaviors), "discipline" (25 behaviors), and "feeding" (22 behaviors). These 9 subscales are assessed by checking the number of behaviors in each subscale that the child can perform, and the developmental age and developmental quotient of the child can be evaluated. Using the 9 areas of development, this test produces a clear profile of the developmental age and developmental quotient of the child. Miyake et al.[1] have reported that the KIDS has a reliability coefficient of 0.95 and a correlation coefficient with the Stanford-Binet Intelligence Scales of 0.856 and with the Wechsler Preschool and Primary Scale of Intelligence of 0.653. They concluded that the KIDS is valuable for diagnosing developmental disorders because the level of development can be established in 9 areas[1].

Fig. 1 shows examples of behaviors that are assessed in the KIDS. The KIDS is an extremely simple scale that assesses various kinds of activities that young children can or cannot perform. The developmental age and developmental quotient are calculated by counting the numbers of behaviors that a child can perform. Although the KIDS has 4 different types of questionnaire (A, B, C, and T), we used the KIDS type T, which is appropriate for disabled children with developmental retardation.

The WeeFIM utilizes the same items and rating scale as the Adult FIM. The 18 items in the WeeFIM are organized into the 6 subscales of self-care, sphincter control, transfers, locomotion, communication, and social cognition. Each item is scored on a 7-level ordinal scale indicating the degree of assistance needed to perform an activity : level 7=complete independence (timely, safely), level 6=modified independence (assistive device needed), level 5=modified dependence (supervision or setup), level 4=modified dependence (minimal assistance, subject participation=75% +), level 3=modified dependence (moderate assistance, subject participation=50% +), level 2=almost complete dependence (maximal assistance, subject participation=25% +), and level 1=complete dependence (total assistance, subject=0% +).

We recorded the total scores of the motor WeeFIM and cognitive WeeFIM, which are the sum of the scores for the subscales of self-care, sphincter control, transfers, and locomotion, and of communication and social cognition, respectively.

Data Analysis

Using Spearman's rank correlation coefficients, we examined the strength of the association between the developmental age and developmental quotient of the KIDS with the total scores of the motor WeeFIM and cognitive WeeFIM as determined in all children by occupational therapists at our hospital. In addition, all 11 children were retested with the KIDS by their families on the same day.

Instructions: Please answer the questions as to what your child can or cannot do.

My child ….

	Yes	No		Age of month
1	O	×	Turns his/her head while watching a moving object according to the movement of the object.	<1>
2	○	×	Can lift his/her head while he/she is in the prone position.	<2>
3	○	×	Can lift his/her chest and head using both arms while he/she is in the prone position.	<3>
4	○	×	Can maintain a sitting position if supported.	<4>
5	○	×	Kicks his/her legs when he/she is lifted off the ground.	<5>
6	○	×	Can maintain a standing position if supported under his/her arms.	<6>
7	○	×	Can roll over.	<7>
8	○	×	Can stand up if holding onto something with both hands.	<8>
9	○	×	Can crawl.	<9>
10	○	×	Can maintain a standing posture by himself/herself for a short period of time.	<10>
11	○	×	Can bend forward.	<11>
12	○	×	Can maintain a standing posture by himself/herself without support for several seconds.	<12>
13	○	×	Moves his/her body in rhythm.	<14>
14	○	×	Can climb the stairs if someone holds his/her hand.	<15>
15	○	×	Can walk about 200 meters by himself/herself.	<16>
16	○	×	Can walk while pushing a tricycle or the like.	<17>
17	○	×	Can throw a ball overhand.	<18>
18	○	×	Can walk backwards without holding onto anything.	<19>
19	○	×	Can stand on tiptoes.	<20>
20	○	×	Can hang from a horizontal bar.	<22>
21	○	×	Can climb the stairs using one leg after the other.	<25>
22	○	×	Tries to hop on one foot.	<28>
23	○	×	Can ride a tricycle or a bicycle with training wheels.	<33>
24	○	×	Can stand on a swing by himself/herself.	<36>
25	○	×	Can grab a rolling ball.	<38>
26	○	×	Can hop on one foot.	<39>
27	○	×	Can run smoothly at full speed for approximately 20 meters.	<40>
28	○	×	Can climb the jungle gym at the park to the top.	<42>
29	○	×	Can walk backwards on tiptoes.	<45>
30	○	×	Can stand on a swing.	<46>
31	○	×	Can skip.	<49>
32	○	×	Can enjoy a relay race with other children.	<60>
33	○	×	Can dribble a ball about three times.	<61>
34	○	×	Can chase other children on the jungle gym without touching his/her feet to the ground.	<63>
35	○	×	Can swing very high while standing on the swing.	<65>
36	○	×	Can jump rope by himself/herself.	<68>
37	○	×	Can ride a bicycle without training wheels.	<77>

Fig. 1. A list of 37 behaviors in the "physical motor" subscale of the Kinder Infant Development Scale (KIDS) Type T. The age at which a normal child is expected to be able to perform each behavior is shown in brackets.

The internal consistency of the 9 subscales comprising the KIDS was checked by Cronbach's coefficient alpha (Cronbach's α). Interrater reliability for each task was established using intraclass correlation coefficients (ICCs). Data were analyzed with the software package IBM SPSS Statistics 12.0 J (IBM Japan Ltd., Tokyo, Japan).

Results

The total scores of the motor WeeFIM and cognitive WeeFIM were each significantly correlated with the developmental age and developmental quotient of the family-rated and staff-rated KIDS (Table 1). And the developmental age assessed with KIDS was correlated with the developmental age on ESID (Table 1). The 9 subscales of the KIDS rated by staff and by the families had appropriate internal consistency (Cronbach's $\alpha=0.981$ and 0.982), and the results of analysis of interrater reliability of the KIDS indicated almost perfect reliability for all 9 subscales and developmental age and developmental quotient (ICC=0.944-0.997) (Table 2).

Discussion

In the field of pediatric rehabilitation, tests commonly used to assess the motor and cognitive function of children

Table 1. Correlations among the KIDS scores, ESID, WeeFIM scores, and Age

Variable	(*n*=11) Median	Range	with motor ESID r	with motor WeeFIM r	with cognitive WeeFIM r	Age, years r
Kinder Infant Development Scale (KIDS)						
Family-rating developmental age	0.67	0.25-3.50	0.659*	0.841**	0.789**	0.659*
Family-rating developmental quotient	31.00	11.00-93.00	0.382	0.679*	0.627*	0.382
Staff rating developmental age	0.58	0.25-3.25	0.677*	0.834**	0.794**	0.677*
Staff-rating developmental quotient	33.00	11.00-91.00	0.419	0.755**	0.733*	0.419
Enjoji Scale of Infant Analytical development (ESID)	2.00	0.92-3.92		0.694*	0.749**	1.000**
motor WeeFIM	13.00	13-77	0.694*		0.854**	0.694*
cognitive WeeFIM	5.00	5-26	0.749**	0.854**		0.749**
Age, years	2.00	0.92-3.92	1.000**	0.694*	0.749**	

**$P>0.01$, *$P>0.05$

KIDS= Kinder Infant Development Scale, ESID= Enjoji Scale of Infant Analytical development, WeeFIM=Functional Independence Measure for Children

Table 2. Inter-rater reliability of each KIDS subscale, developmental age, and developmental quotient with intraclass correlations among 11 pediatric patients

Inter-rated KIDS	Rater	(*n*=11) Median	(*n*=11) Range	Reliability ICC
Physical motor	Family	9.00	4-26	0.954
	Staff	10.00	4-24	
Manipulation	Family	9.00	4-30	0.944
	Staff	9.00	3-23	
Receptive language	Family	9.00	6-29	0.992
	Staff	10.00	5-28	
Expressive language	Family	9.00	0-26	0.987
	Staff	9.00	0-23	
Language concepts	Family	4.00	0-17	0.958
	Staff	7.50	0-14	
Social relationships with children	Family	6.50	1-17	0.982
	Staff	5.50	1-17	
Social relationships with adults	Family	13.00	5-28	0.983
	Staff	13.00	5-29	
Discipline	Family	6.50	1-13	0.979
	Staff	8.00	2-13	
Feeding	Family	3.00	0-21	0.997
	Staff	3.00	0-21	
Developmental age	Family	0.67	0.25-3.50	0.989
	Staff	0.58	0.25-3.25	
Developmental quotient	Family	31.00	11-93	0.958
	Staff	33.00	11-91	

KIDS= Kinder Infant Development Scale, ICC= intra-class correlations

with disabilities include the Gross Motor Function Classification System (GMFCS), the Gross Motor Function Measure, WeeFIM, the Pediatric Evaluation of Disability Inventory, and the Bailey Motor Developmental Scale. Morris and Bartlett[3] have reported that the GMFCS has had, and continues to have, a major effect on the health care of children with cerebral palsy. The GMFCS continues to be cited in publications and is well accepted internationally and across the spectrum of health professionals for use in research design and clinical practice by providing a system for clearly communicating children's gross motor function. On the other hand, Kondo et al.[4] have examined the reliability of the Japanese version of the GMFCS and using a Delphi survey determined the opinions of experts on the clinical use of the GMFCS. They concluded that the reliability of levels III and IV in the GMFCS was somewhat lower because the level III description for ages 4 to 6 years indicated a lower level than what is usual in this age group[4]. In a systematic literature review of assessment measures, Ketelaar et al.[5] concluded that only 2 evaluative assessment measures, the Gross Motor Function Measure and the Pediatric Evaluation of Disability Inventory, fulfill the criteria for reliability and validity with respect to responsiveness to change in a child's condition. After testing the reliability of the WeeFIM in 37 children without disabilities and 30 children with disabilities, Ottenbacher et al.[6] found this instrument to be reliable. They have also reported that the WeeFIM could be used to document changes in functional abilities over a 1-year period in 173 children with chronic disabilities[7]. However, these instruments are not commonly used during pediatric examinations because they are difficult to administer in regular clinical practice.

Administering the specialized scales used in rehabilitation medicine can be difficult. We evaluated the KIDS to make available an instrument that can easily be used to assess a child's physical and mental development in daily life. One advantage of the KIDS in comparison with other scales, such as the WeeFIM and ESID, is that the families can easily record the child's ability to perform various behaviors in 9 different areas of development and, thereafter, can monitor the progress of that child's ability to perform each individual motor and cognitive skill from the ages of 1 month to 6 years 11 months. In the present study we found high correlations between the developmental age or developmental quotient on the family-rated and staff-rated KIDS with the developmental age as assessed with ESID and the motor and cognitive WeeFIM scores (Table 1). Also, the interrater reliability for each subscale was established with ICCs (Table 2). On the basis of these results, we believe that the KIDS as rated by family or staff can be used to evaluate the ability of children. On the other hand, there were large discrepancies in evaluation between family and staff because abstractive expressions had been used in questionnaires for the "language concepts" subscale.

A limitation of the present study was that the subjects did not undergo the KIDS examination at home in an environment compatible with daily life but at a rehabilitation gymnasium in our hospital. Patients must sometimes be assessed in situations other than the hospital. Therefore, future research should consider ways to use KIDS to evaluate patients at home.

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