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BRIEF COMMUNICATION

Validity and Reliability of the Korean-Translated Version of the International Cooperative Ataxia Rating Scale in Cerebellar Ataxia

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ABSTRACT

Objective The International Cooperative Ataxia Rating Scale (ICARS) is a semiquantitative clinical scale for ataxia that is widely used in numerous countries. The purpose of this study was to investigate the validity and reliability of the Korean-translated version of the ICARS.

Methods Eighty-eight patients who presented with cerebellar ataxia were enrolled. We investigated the construct validity using exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). We also investigated the internal consistency using Cronbach's α and intrarater and interrater reliability using intraclass correlation coefficients.

Results The Korean-translated ICARS showed satisfactory construct validity using EFA and CFA. It also revealed good interrater and intrarater reliability and showed acceptable internal consistency. However, subscale 4 for assessing oculomotor disorder showed moderate internal consistency.

Conclusion This is the first report to investigate the validity and reliability of the Korean-translated ICARS. Our results showed excellent construct and convergent validity. The reliability is also acceptable.

Keywords Cerebellar ataxia; Republic of Korea; Validation study.

Ataxia is a term for impairment in the coordination of movement and presents as a disorder involving complex multiple functional movements. Due to various clinical presentations, it is difficult to objectively measure the severity of ataxia. The International Cooperative Ataxia Rating Scale (ICARS) was first developed in 1996 and has been widely used for semiquantita-

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tive measurement of ataxia.[1] The ICARS is composed of 19 items and 4 subscales for assessing gait and ability to stand, motor function, speech, and eye movements. The ICARS was originally written in English and required translation and validation for use in countries where other languages are spoken.[2] However, there has been no report on the validity and reliability of the Korean-translated version of the ICARS. As the prevalence of patients with ataxia in Korea has been increasing, it is necessary to validate the Korean-translated version of ICARS.

MATERIALS & METHODS

Translation process

The translation and back translation methods were applied for translation to Korean.[3] The group of translators was composed of two Korean neurologists, one of whom had lived in an English-speaking country for 3 years. The group of back translators was composed of a Korean neurologist and a nonmedical native speaker of English. After backtranslation, all translators reviewed and compared the translated piece to the original version, and any errors were corrected with consideration of Korean cultural differences. The final translated version was supervised by the Korea−US education and cultural exchange association called KoAm Education Alliance (Supplementary Material in the online-only Data Supplement).

Participants

This study was a multicenter cross-sectional study. The inclusion criteria were patients aged 20−80 years who presented with cerebellar ataxia. Exclusion criteria included the presence of 1) other neurological and orthopedic symptoms that affect movement and gait.; 2) severe fall risk, deeming patients unable to undergo ICARS; and 3) fluctuating symptoms within one month.

All participants performed the Korean translated version of the ICARS, Timed Up and Go (TUG) test and the Korean Tinetti mobility test (TMT).[4,5] Informed consent was obtained from all participants, and this study was approved by the Institutional Review Board (IRB number: HP2021-05-04).

Statistical methods

Validity

For construct and convergent validity, exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were performed. Before performing EFA, the Kaiser−Mayer−Olkin and Bartlett's tests were used for sampling adequacy. To assist in interpreting the factors, varimax orthogonal rotation was used. Before constructing a common factor model, initial eigenvalues from a screen plot were used as guidelines for deciding the number of factors. Item loading was used with absolute values greater than 0.4 to describe the factors.

For CFA, five model fit indices and their criteria were used to examine the goodness-of-fit. We evaluated the minimum chi-square/degrees of freedom (CMIN/DF), Tucker−Lewis index (TLI), comparative fit index (CFI), standardized root mean square (SRMR), and root mean square error of approximation (RMSEA) as model fit indices. CMIN/DF values below 3, SRMR values below 1.0, RMSEA values below 0.8, and CFI and TLI values above 0.9 were considered to indicate acceptable model adjustment.[6] For concurrent validity, Spearman's rank correlation coefficient with the TMT, TUG and disease duration was calculated.

Reliability

Cronbach's alpha coefficient was used to calculate internal consistency. A value above 0.7 was considered good, and above 0.6 was considered moderate.[7] The intraclass correlation coefficient (ICC) was used for intrarater and interrater reliability, and above 0.75 was considered good.[8] For interrater reliability, the test−retest method was used. The two raters facilitated the ICARS at the same time, and one of them performed the ICARS again in the same set of patients within 4 weeks.

RESULTS

Participants

We enrolled 88 patients in 6 different movement clinics in tertiary hospitals in this study. All subjects were Korean, and the mean age was 61.25 years; 56.8% of the participants were men. Causative diseases included multiple system atrophy (53.4%), spinocerebellar ataxia (18.2%), idiopathic cerebellar ataxia (17%), postinfectious cerebellar ataxia (2.3%), and others (15.7%).

Construct and convergent validity

Table 1 shows the factor loading of each item derived from EFA. Subscale 2 has three factors, and a total of six factors were extracted in the ICARS from EFA. The factor loading of each item showed a high correlation with other items that belonged to the same subscale. However, Item 14 under subscale 2 showed a relatively low correlation with other items in the same subscale (0.5), but it showed a high correlation with items in subscale 3. For CFA, all the fit indices were satisfactory: CMIN/DF = 1.519, TLI = 0.908, CFI = 0.924, SRMR = 0.694, and RMSEA = 0.77.

Criterion validity

Concurrent validity was used for the criterion validity. The total score of the ICARS was significantly correlated with the scores

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Table 1. Factor lording in all items in exploratory factor analysis

Factors	Variables	Factor loading					
		I. Posture and gait disturbances	II. Kinetic functions	II. Kinetic functions	III. Speech disorders	IV. Oculomotor disorders	II. Kinetic functions
I. Posture and gait disturbances	1. Walking capacities	0.83	0.14	0.27	0.07	-0.06	0.17
	2. Gait speed	0.82	0.20	0.06	-0.05	-0.16	0.16
	3. Standing capacities, eyes open	0.82	0.21	0.12	0.22	-0.01	0.04
	4. Spread of feet in natural position without support, eyes open	0.72	0.31	0.16	0.17	0.17	0.16
	5. Body sway with feet together, eyes open	0.89	0.10	0.08	0.15	0.09	0.03
	6. Body sway with feet together, eyes closed	0.84	0.04	0.07	0.15	0.10	0.06
	7. Quality of sitting position	0.57	0.11	0.33	0.30	0.12	-0.26
II. Kinetic functions	8. Knee-tibia test: decomposition of movement and intention tremor (Right)	0.19	0.16	0.84	0.22	0.09	0.13
	8. Knee-tibia test: decomposition of movement and intention tremor (Left)	0.24	0.16	0.85	0.18	0.03	0.15
	9. Action tremor in the heel-to-knee test (Right)	0.12	0.30	0.84	-0.01	0.23	0.09
	9. Action tremor in the heel-to-knee test (Left)	0.15	0.30	0.81	0.06	0.19	-0.03
	10. Finger-to-nose test: decomposition and dysmetria (Right)	0.22	0.77	0.25	0.30	0.30	-0.07
	10. Finger-to-nose test: decomposition and dysmetria (Left)	0.15	0.78	0.19	0.31	0.29	-0.04
	11. Finger-to-nose test: intention tremor of the finger (Right)	0.17	0.87	0.21	0.02	-0.01	0.20
	11. Finger-to-nose test: intention tremor of the finger (Left)	0.18	0.87	0.19	0.06	0.04	0.15
	12. Finger-finger test: action tremor and/or instability (Right)	0.17	0.65	0.12	0.16	0.08	0.23
	12. Finger-finger test: action tremor and/or instability (Left)	0.14	0.67	0.19	0.13	0.15	0.28
	13. Pronation-supination alternating movements (Right)	0.17	0.29	0.18	0.19	0.12	0.85
	13. Pronation-supination alternating movements (Left)	0.18	0.31	0.10	0.30	0.12	0.81
	14. Drawing of the Archimedes' spiral on a predrawn pattern	0.17	0.18	0.22	0.50	-0.21	0.12
III. Speech disorders	15. Dysarthria: fluency of speech	0.28	0.15	0.07	0.83	0.13	0.15
	16. Dysarthria: clarity of speech	0.16	0.24	0.11	0.80	0.02	0.19
IV. Oculomotor disorders	17. Gaze-evoked nystagmus	0.06	0.07	0.02	-0.06	0.79	-0.08
	18. Abnormalities of the ocular pursuit	0.02	0.20	0.17	0.10	0.75	0.15
	19. Dysmetria of the saccade	0.00	0.18	0.29	-0.01	0.61	0.24
Eigen value		9.92	3.02	1.99	1.52	1.36	1.19
Variance Explanatory power (%)		39.69	12.09	7.95	6.07	5.44	4.75
Cumulative variance (%)		39.69	51.78	59.73	65.80	71.25	76.00
KMO: 0.824, Barlett's test of sphericity test χ^2 = 1,964.525, p < 0.001							

KMO, Kaiser–Mayer–Olkin.

Table 2. Crohnbach's α coefficient for internal consistency and ICC for reliability

Classification	Internal consistency	Inter-rater reliability (*n* = 83)		Intra-rater reliability (*n* = 39)	
	Cronbach's α	ICC (95% CI)	*p*	ICC (95% CI)	*p*
I. Posture and gait disturbances	0.916	0.982 (0.972–0.988)	< 0.001	0.976 (0.955–0.987)	< 0.001
II. Kinetic functions	0.837	0.943 (0.906–0.964)	< 0.001	0.940 (0.889–0.968)	< 0.001
III. Speech disorders	0.838	0.849 (0.765–0.903)	< 0.001	0.967 (0.938–0.982)	< 0.001
IV. Oculomotor disorders	0.654	0.765 (0.587–0.859)	< 0.001	0.938 (0.886–0.967)	< 0.001
Total International Cooperative Ataxia Rating Scale	0.907	0.962 (0.941–0.976)	< 0.001	0.979 (0.960–0.989)	< 0.001

ICC, intraclass correlation coefficient; CI, confidence interval.

of TMT (r = -0.695, p < 0.01) and TUG (r = -0.308, p < 0.01), indicating high concurrent validity of the total score of ICARS. Subscales 1, 2, and 3 were significantly correlated with TMT (r = -0.820, p < 0.01; r = -0.428, p < 0.01; r = -0.361, p < 0.01, respectively). However, only subscale 1 had a significant positive correlation with TUG (r = 0.621, p < 0.01). The total ICARS score showed a significant correlation with disease duration (r = 0.251, p = 0.02). Subscale 3 was significantly correlated with disease duration (r = 0.280, p < 0.01).

Reliability

Table 2 shows the results of the evaluation of the reliability. Cronbach's alpha coefficient for the total ICARS score was 0.907, indicating sufficient reliability. Cronbach's alpha coefficients of subscales 1, 2, and 3 were acceptable (0.916, 0.837, 0.838, respectively); however, that of subscale 4 showed a relatively lower value (0.654). The interrater ICC of the total ICARS score was 0.96, and the intrarater ICC of the total ICARS score was 0.98. Subscale 1 had the highest reliability, while subscale 4 showed the lowest reliability despite an acceptable range.

DISCUSSION

In our results, the Korean-translated version of the ICARS showed acceptable validity and reliability. There have been two commonly used scales for patients with ataxia, including the Scale for the Assessment and Rating of Ataxia (SARA) and ICARS. Only one report on SARA has been translated into the Korean language and has been validated in stroke patients.[9] There are still no clinical scales applicable for Korean-speaking individuals for cerebellar ataxia except in cases of stroke.

After applying EFA to investigate the factorial structure, the number of factors was 6, with eigenvalues greater than 1 even if the ICARS was composed of 4 subscales. The validation study of English ICARS in SCA revealed that 4 factors had eigenvalues greater than 1.[10] However, some previous studies have often reported more than 4 factors in factor analysis. The validation study of ICARS in focal cerebellar lesions revealed 5 extracted factors with eigenvalues greater than 1.[11] In another study, the Turkish version of the ICARS in multiple sclerosis also extracted 5 factors in principal component analyses.[12] Subscale 2 is an assessment of kinetic function that measures movement of the upper and lower extremities. Therefore, factor loadings are grouped according to the movement of body parts, including the lower extremities, arm, and fingers.

Previous studies on the convergent validity of the ICARS have shown inconsistent results.[13,14] In our study, Item 14, which measures the drawing skill of the Archimedes loop, showed relatively low association with other items under subscale 2 in EFA. Similar results regarding Item 14 as a hindrance factor for validity have been reported in previous studies.[11] We postulate several limitations of Item 14 that might cause this result. First, the size of the Archimedes loop can affect the drawing performance; however, there are no exact descriptions of the size of the Archimedes loop in ICARS. Second, a Korean word for "hypermetric swerve" was not often used; therefore, this may be unfamiliar to Korean-speaking individuals.

The English version of the ICARS has been proven to have excellent reliability.[15] Cronbach's alpha coefficient and ICC for assessing the reliability of total ICARS scores revealed acceptable internal reliability in our results. However, Cronbach's alpha coefficient and the ICC score of subscale 4 were lower than those of the other subscales despite a moderate range of internal consistency. These findings are also often reported in other reports, suggesting an inherent limitation of ICARS itself and not the translation process.[10,13] It is difficult to quantitatively estimate eye movement by observation because subtle differences in ocular dysfunction can be influenced by the subjective judgment of the observer.

This study has several limitations. First, we only analyzed correlations with scales of gait for concurrent validity. Overall assessment of daily function, such as the modified Barthel index, could not be measured for concurrent validity. Additionally, we could not evaluate other ataxia scales, such as SARA, because there are no validated Korean-translated versions of these scales. Second, our data collection was limited to the clinical symptoms of cerebellar ataxia in patients and not specific diseases.

In conclusion, the Korean-translated version of the ICARS showed excellent validity and reliability for cerebellar ataxia. Although some hindrance factors were identified, these results have often been reported as limitations of the ICARS itself. Our study makes it possible to apply the ICARS to Korean-speaking patients with ataxia in clinical and research settings.

Supplementary Materials

The online-only Data Supplement is available with this article at https://doi.org/10.14802/jmd.22137.

Conflicts of Interest

The authors have no financial conflicts of interest.

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Author Contributions

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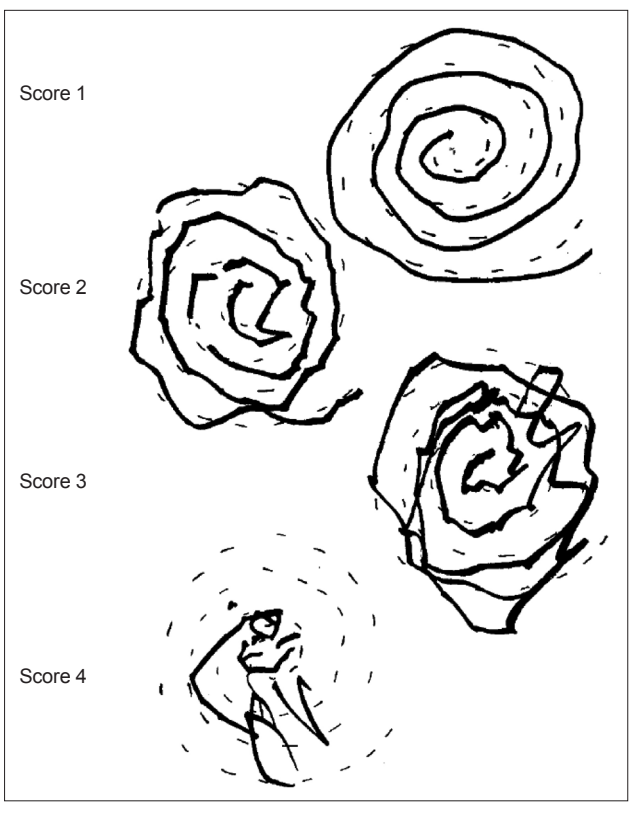
SUPPLEMENTARY MATERIAL

국제 협력 ATAXIA(운동실조) 등급 척도

I: 자세 및 걸음걸이 장애		점수:
1. 걷기 능력 약 1.5 미터 거리의 벽 근처에서 반쯤 돌기를 포함한 10 미터 검사를 통해 관찰함	0: 정상 1: 자연스럽게 거의 정상이나 발을 앞뒤로 하며 걸을 수는 없음 2: 도움 없이 걷기는 하나 명백히 비정상적이거나 불규칙적임 3: 도움 없이 걷기는 하나 상당한 정도의 비틀거림이 있으며, 반쯤 돌기에 어려움이 있음 4: 스스로 걷기가 불가능하며, 10 미터를 걷는 동안 벽을 사용함 5: 한 개의 지팡이가 있어야 걸을 수 있음 6: 두 개의 특수 지팡이를 사용하거나 스트롤러가 있어야 걸을 수 있음 7: 도와주는 사람이 있어야 걸을 수 있음 8: 도와주는 사람이 있어도 걸을 수 없음 (휠체어)	
2. 걷기 속도 이전 검사에서 1~3점을 받은 환자의 경우에만 관찰함. 4점 이상을 받은 환자는 자동적으로 이 검사에서 4점을 받게 됨	0: 정상 1: 약간 감소됨 2: 뚜렷하게 감소됨 3: 매우 느림 4: 스스로 걷기가 불가능함	
3. 서있기 능력, 눈을 뜨고 우선 환자로 하여금 한 발로 서라고 함. 그것이 가능하지 않으면, 발을 앞뒤로 하고 서라고 함. 그것도 안되면, 두 발을 모은 상태로 서라고 함. 자연스러운 자세라 함은 환자가 편하게 느끼는 서있는 자세를 말함	0: 정상, 10초 이상 한 발로 서있을 수 있음 1: 발을 모은 상태로 서 있을 수는 있으나, 10초 이상 한 발로 서있을 수는 없음 2: 발을 모은 상태로 서 있을 수는 있으나, 발을 앞뒤로 하고 서있을 수는 없음 3: 발을 모은 상태로 서 있을 수 없으나, 자연스러운 자세로는 아무 도움 없이도 서있을 수 있고, 이때 전혀 흔들림이 없거나 약간의 흔들림이 있음 4: 자연스러운 자세로 아무 도움 없이 서있을 수는 있으나, 상당한 정도의 흔들림이 있고 자세를 다시 잡아야 함 5: 양팔을 꽉 잡아주지 않으면 서있을 수 없음 6: 양팔을 꽉 잡아주더라도 전혀 서있을 수 없음	
4. 도움 없이 자연스러운 자세로 설 때 두 발의 간격, 눈은 뜬 상태 환자로 하여금 편안한 자세로 서라고 한 후 안쪽 복숭아뼈 사이의 거리를 측정함	0: 정상, < 10 cm 1: 약간 벌어짐, > 10 cm 2: 분명히 벌어짐, 25 cm < 간격 < 35 cm 3: 매우 많이 벌어짐, > 35 cm 4: 자연스러운 자세로 서있기가 불가능함	
5. 발을 모은 상태로 서있을 때 몸의 흔들림, 눈은 뜬 상태	0: 정상 1: 약간의 흔들림 2: 중간 정도의 흔들림 (머리가 < 10 cm 흔들림) 3: 서있기가 어려울 정도로 매우 많이 흔들림 (머리가 > 10 cm 흔들림) 4: 곧바로 넘어짐	
6. 발을 모은 상태로 서있을 때 몸의 흔들림, 눈은 감은 상태	0: 정상 1: 약간의 흔들림 2: 중간 정도의 흔들림 (머리가 < 10 cm 흔들림) 3: 서있기가 어려울 정도로 매우 많이 흔들림 (머리가 > 10 cm 흔들림) 4: 곧바로 넘어짐	
7. 앉아있는 자세의 모습 허벅지를 붙이고 팔짱을 낀 채로 딱딱한 면에 앉아서 진행	0: 정상 1: 약간 몸의 흔들림이 있음 2: 중간 정도의 몸과 다리의 흔들림이 있음 3: 상당한 정도의 평형이상 4: 불가능함	
자세 및 걸음걸이 점수 (정적 점수)		_____ / 34

II. 운동기능		점수:
8. 무릎-정강이 검사 분절화된 움직임(decomposition) 및 의도 떨림 이 검사는 환자가 머리를 들고 바로 누워 시각적으로도 몸의 움직임을 조정할 수 있는 상태에서 실행함. 환자로 하여금 한 쪽 다리를 들어 발뒤꿈치를 다른 쪽 무릎에 올려놓고 그 뒤꿈치를 정강이를 따라 발목부근까지 천천히 내리라고 함. 뒤꿈치가 발목에 오면 약 40 cm 높이로 다리를 들어보라고 함. 이러한 동작을 반복하되 각 다리 당 적어도 3번 이상 반복해야 적절한 평가가 가능함	0: 정상 1: 발뒤꿈치가 연속된 축으로 정강이를 따라 내려가지만, 그 움직임에 여러 번 분절화된 움직임이 있음. 하지만, 발이 툭툭거리거나 매우 느리게 움직이지는 않음 2: 축 안에서 정강이를 따라가기는 하지만 툭툭거림 3: 정강이를 옆으로 벗어나면서 툭툭거리며 내려감 4: 정강이를 매우 심하게 옆으로 벗어나면서 툭툭거리며 내려가거나 검사 자체가 불가능함 (분절화: 움직임이 연속적이지 않고 끊어짐)	우: 좌:
9. '발뒤꿈치를 무릎으로' 검사에서 보는 동작 떨림 이전 검사와 동일하게 진행함. 환자가 한 쪽 다리를 들어 발뒤꿈치를 다른 쪽 무릎에 올려놓고 그 뒤꿈치가 정강이를 따라 발목부근까지 내리기 전, 무릎 위치에서 몇 초간 머무르게 함. 환자가 스스로의 움직임을 볼 수 있어야 함	0: 아무 문제 없음 1: 발뒤꿈치가 무릎에 놓이자마자 떨림이 중단됨 2: 발뒤꿈치가 무릎에 놓인 후 10초가 되기 전 떨림이 중단됨 3: 발뒤꿈치가 무릎에 놓인 후 10초 이상 떨림이 지속됨 4: 떨림이 멈추지 않거나 검사가 불가능함	우: 좌:
10. '손가락을 코로' 검사 분절화된 움직임(decomposition) 및 운동조절장애 이 검사는 환자가 의자에 앉아 손을 무릎 위에 얹은 상태에서 시작함. 환자는 눈으로 자신의 움직임을 확인할 수 있어야 하며, 적절한 검사를 위해 각 손 당 세(3)번 검사를 진행해야 함	0: 아무 문제 없음 1: 분절화된 움직임은 없으나 흔들림은 있음 2: 손가락이 코에 닿기 전 두(2)번 이상 움직임이 끊기거나 운동조절장애가 어느 정도 보임 3: 손가락이 코에 닿기 전 두(2)번 이상 움직임이 끊기거나 상당한 운동조절장애가 있음 4: 운동조절장애가 심해 손가락을 코에 닿게 하지 못함	우: 좌:
11. '손가락을 코로' 검사 손가락 의도 떨림 여기서 검사하고자 하는 손가락 동작 떨림은 검사의 시작단계에서 확인됩니다. 환자가 의자에 편안히 앉아 손을 허벅지 위에 얹은 상태, 그리고 눈으로 자신의 움직임을 확인할 수 있는 상태에서 시작되며, 적절한 검사를 위해 각 손 당 세(3)번 검사를 진행해야 함	0: 아무 문제 없음 1: 간단한 흔들림이 있음 2: 대략 10 cm 이하의 떨림이 있음 3: 대략 10–40 cm 정도의 떨림이 있음 4: 대략 40 cm 이상의 강렬한 떨림이 있음	우: 좌:
12. '손가락 마주보기' 검사 동작 떨림 및 불안정 앉은 자세에서 눈을 뜨고 보면서, 양손 검지를 가슴 높이에서 1 cm 정도 거리를 두고 약 10초 동안 서로를 바라보도록 함	0: 정상 1: 약간의 불안정 2: 대략 10 cm 이하의 손가락 흔들림 3: 대략 10–40 cm 정도의 손가락 흔들림 4: 40 cm 이상의 툭툭거림	우: 좌:
13. 손바닥 뒤집기 교대운동 앉은 자세에서 팔을 수직으로 들어올린 후 손바닥을 앞뒤로 번갈아 흔들게 함. 오른손 왼손을 따로 진행함	0: 정상 1: 약간의 고르지 않음 및 느려짐 2: 확실히 고르지 않음 및 느려짐. 팔꿈치의 흔들림은 없음 3: 심하게 고르지 않음 및 느려짐. 팔꿈치의 흔들림이 있음 4: 움직임 자체가 완전히 이상하거나 불가능함	우: 좌:
14. 그림 그리기 본을 따라 아르키메데스의 나선 그리기 환자로 하여금 책상 앞에 편하게 앉게 함. 책상 위에는 워크시트를 고정시켜 놓음. 환자로 하여금 시간제한 없이 주어진 작업을 하게 함. 각 검사마다 같은 조건을 갖추어야 함	0: 정상 1: 장애와 분절화된 움직임이 있음, 주어진 점선을 약간 벗어나지만 측정과대증 흔들림(hypermetric swerve)은 없음 2: 주어진 점선에서 완전히 벗어나긴 하나 선을 겹치거나 측정과대증 흔들림은 없음. 3: 측정과대증과 분절화된 움직임에 의해 심각한 어려움이 있음 4: 그리기가 완전히 잘못되거나 불가능함 (측정과대증: 과도하게 빗나가는 모양)	
운동 점수 (팔다리 조정력):		_____ / 52

예시 페이지
아르키메데스의 나선 그리기 검사의 채점



III: 말하기 장애		점수:
15. 구음장애 말하기의 유창성 환자로 하여금 기본적인 문장을 똑같이 여러 번 반복하도록 지시함.	0: 정상 1: 약간의 유창성 부족 2: 중간 정도의 유창성 부족 3: 상당히 느리며 구음장애가 있음 4: 말을 하지 못함	
16. 구음장애 말하기의 명확성	0: 정상 1: 약간 불분명함 2: 확실히 불분명하지만 무슨 말을 하는지 알아들을 수는 있음 3: 심하게 불분명하며 무슨 말을 하는지 알아들을 수 없음 4: 말을 하지 못함	
구음장애 점수:		_____ / 8

IV: 동안근 장애		점수:
17. 주시유발안진 환자로 하여금 검사관의 손가락을 측면으로 보게 함. 안구의 움직임은 주로 좌우로 움직이는 것을 측정하는 것이나, 사선으로나 둥글게 돌거나 수직적인 움직임도 있을 수 있음	0: 정상 1: 일시적. 2: 지속적이나 심하지는 않음 3: 지속적이며 심함	
18. 따라보기의 장애 환자로 하여금 검사관이 천천히 좌우로 움직이는 손가락을 따라보게 함	0: 정상 1: 약간의 단속성(saccadic)이 있음 2: 확실히 단속성(saccadic)이 있음	
19. 신속눈운동에서 운동조절 장애 검사관의 두 검지를 환자의 각 눈의 시야에 놓고 환자로 하여금 눈을 좌우로 움직이게 함. 환자의 안구가 너무 많은 또는 작은 폭으로 움직이는지 평가함	0: 장애가 없음 1: 양측으로 확실한 지나침이나 도달하지 못함이 있음	
동안근 운동 점수:		_____ / 6
총 ATAXIA (운동실조) 점수:		_____ / 100