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Dysphagia

McGill Ingestive Skills Assessment (MISA): Development and First Field Test of an Evaluation of Functional Ingestive Skills of Elderly Persons

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Abstract. There is a lack of reliable and valid clinical assessment tools for individuals with loss of ingestive skills. The McGill Ingestive Skills Assessment (MISA) was developed to facilitate the reliable and valid bedside assessment of elderly persons with feeding difficulties. Items were generated by a literature review and selected with the collaboration of a multidisciplinary team. The first version of the MISA comprised 190 items in 7 scales, covering the domains of medical history, mealtime environment, physical characteristics of the patient, food textures consumed, solid ingestion, liquid ingestion, and behaviors related to self-feeding. The first field test for item selection included 50 individuals, aged 60 years and older, living in the community, supervised housing, and long-term care centers. After field testing, 134 items were eliminated due to poor face validity, redundancy, or poor psychometric performance. The remaining 56 items were provided with 4 response categories and were reorganized into 5 scales. The revised version was field tested to determine its preliminary psychometric properties on 33 individuals, 60 years of age and older, residing in a long-term care center. Six items were eliminated due to redundancy after the second field test. Analyses of the revised version resulted in the elimination of another 6 items that were redundant or that demonstrated poor reliability. Internal consistency of all scales is ≥0.86 and interrater agreement is ≥0.92. These analyses suggest that the psychometric properties of the MISA are adequate for diagnosis and treatment planning. This supports its readiness for clinical use following further reliability and validity testing with a larger sample

Key words: Dysphagia — Clinical — Feeding — Neurologic impairment — Psychometric properties — Deglutition — Deglutition disorders.

Dysphagia is a common problem in elderly individuals with chronic health problems. It is estimated that up to 80% of the elderly living in long-term care settings may experience difficulties with self-feeding, chewing, and swallowing [1]. These problems contribute to social isolation [2], malnutrition [3], and respiratory illness aggravated by aspiration [4]. They may also hasten the development of pressure sores and the depression of immune function as a consequence of a poor nutritional state [4]. Death may ensue as a consequence of dysphagia, whether or not aspiration has been documented [5]. Professionals are called upon to assess and treat individuals with these difficulties promptly because of the severe consequences that are associated with functional feeding problems.

Physical examination, neurological assessment, and evaluation of trial swallows are routinely used to identify the deficiencies in anatomy and

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physiological processes causing the feeding problem [6]. Additionally, an instrumental assessment, videofluoroscopy (VF), is often used. In the last few years, the frequent use of VF has been criticized. Scott et al. [7] and Kuhlemeier et al. [8] found that VF is not reliable within a single judge or between judges. VF may also identify a feeding problem where there is none [9]. The occurrence of false positive findings may be a result of positioning the patient in a significantly different way than usual [10], the unfamiliarity of the radiology suite, and the taste and texture of the barium-impregnated food [11]. Thus, instrumental assessment may not be feasible for many elderly individuals with feeding skill loss [12,13]. As a result, there is an urgent need for a more suitable valid and reliable assessment tool [14,15]. A shift in assessment techniques toward functional, observation-based assessment in the individual's own environment has been advocated, in order to document the individual's feeding abilities in his/her natural mealtime setting [15].

Until recently, reliable and valid bedside (clinical) assessment tools have not been available. Scales have begun to appear in the literature, but the development of standardized instruments is a lengthy process and the interest in these types of assessment batteries is relatively new. As a result, the variety of tools available is still limited [16]. The majority of assessments have been developed for children [17–19]. Other assessment tools have been developed for screening [20], for quality of life/quality of care measurement [21–24], and for the translation of information from an instrumental assessment into a disability score [25,26]. However, no reliable and valid bedside assessment tools exist to evaluate an elderly individual's functional feeding skills.

An assessment for this population would require sufficient psychometric rigor to identify individuals with ingestive skill loss, specify the origin of the disability, and serve as a basis for treatment planning. Accordingly, it should allow the clinician to obtain standardized observational information regarding the actual, day-to-day functioning of the patient and to plan rehabilitation in terms of the patient's functional needs, according to the corresponding classification of impairment, disability, handicap (ICIDH, ICIDH-2) [27,28]. The use of a bedside assessment tool would not preclude the use of instrumental techniques but would provide important complementary information in a standardized format. For individuals with little or no cognitive loss who would benefit from oral-motor exercise, biofeedback, or other interactive therapies, a bedside assessment would serve to identify functional difficulties that would be amenable to conservative management. However, the primary population to be served by a bedside assessment will include individuals with an altered mental state, who could not use compensatory strategies or cooperate with an instrumental assessment; the palliative care patient, for whom nonoral feeding or aggressive treatment is not an option; and the frail elderly, for whom an instrumental assessment would bring unwarranted stress.

Therefore, the goal of this study was to develop a reliable and valid bedside assessment of the functional ingestive skills of elderly persons. The development of the assessment tool was undertaken in three stages: In the first, test items were generated; in the second, the number of items was reduced; and in the third, preliminary psychometric testing on the assessment was performed.

Methods

Conceptualization and Item Development

The development of the assessment began in 1996 with a review of the literature. A MEDLINE search using the keywords *deglutition*, *deglutition disorders*, *aspiration*, *swallowing*, and *feeding* from the years 1980 to 1996 was performed. All articles found in the search were reviewed. A list of 208 signs and symptoms of feeding and swallowing problems was compiled from the literature. These signs and symptoms were selected based on repeated clinical reporting or statistical significance of the indicators in clinical studies. These were presented in 14 broad categories (Table 1).

In order to select items from the list, a focus group of clinicians was assembled from the Montreal Regional Multidisciplinary Dysphagia Special Interest Group, a network for professional support and education. An effort was made to maximize the representation of the various institutions within this geographic region. Representatives from both English and French linguistic groups in Montreal were sought because of their differences in training and practice; this was expected to broaden the applicability of the assessment in this cultural milieu. All focus group members had experience in assessing or treating adults or seniors with dysphagia.

The item generation group comprised 4 occupational therapists (including the principal investigator), 2 speech-language pathologists, 2 physicians, 1 registered nurse, and 1 registered dietitian. These professionals work in acute care hospitals (inpatient and outpatient care), chronic care facilities, and rehabilitation centers. All 10 members attended the first meeting and six returned to participate in the second meeting. Four did not attend the second meeting because of scheduling conflicts. Each meeting lasted 3 hours.

During the first meeting, the group discussed the most desirable structure of a clinical tool. Many of the members were skeptical about the feasibility of an assessment where the examiner does not interact with or manipulate the patient. The need for a constant environment to permit optimal performance and the necessity of developing a tool which could assess an individual's functional level were emphasized in response to the group's con-

Table 1. Item generation and selection

	No. in list	Retained from list	Added by focus group	Added by authors
Medical history	14	6	32	7
Dentition	8	6	0	0
Neurologic deficits	27	11	1	5
Oral–respiratory, voice	24	18	11	0
Jaw movement	7	2	0	0
Lip movement	11	9	3	0
Tongue movement	12	3	4	0
Chewing	6	5	4	1
Oral skills	23	12	2	1
Swallow	11	6	3	1
Feeding related behavior	32	14	13	2
Foods eaten	8	4	8	2
Mealtime setting	13	5	8	1
Utensil use	12	12	1	0
Total	208	113	90	20

cerns. It was agreed that the items should fall into specific categories reflecting the various aspects of function that contribute to feeding safety. The categories proposed by the group included medical status, physiological function of head and neck structures, positioning, lighting, noise, behavior, utensil use, oral-motor skills, voice production, and pharyngeal function.

The 208 signs and symptoms from the literature review were presented to the group. One hundred and thirteen items from the list were retained by majority vote by the group members and an additional 90 were added (Table 1). The items generated by the group primarily addressed medical status.

In preparation for the second meeting, the 203 items were phrased as statements and categorical scoring was provided for each item. Twenty more items were added by the authors to ensure face validity of the assessment (Table 1). The 223 items were divided into 7 scales reflecting the domains suggested during the first focus group meeting. The designation of items into scales was done simply by the characteristic in question or the ingestive function to be observed. Items addressing an individual's position were assigned to the Positioning Scale, items to be observed during the consumption of solid textures were assigned to the Solid Ingestion Scale, and so on. Certain items were modified, and some were incorporated into the scoring categories of the evaluation. Hence, the total number of items on the assessment was reduced to 190. At the second meeting, the group voted on each of the new and restored items and all were unanimously accepted. The assignment of the items into their new scales was deemed acceptable. Upon discussion of the scoring mechanism, the group agreed that the number of scoring categories should be tailored to the item and that uniformity across the entire evaluation should be a secondary consideration. The group also felt that scoring the items regarding feeding difficulty by the frequency of their occurrence would be the most desirable means of scoring. The proposed scoring was changed according to the consensus of the group.

At the end of item development (Table 2, A), the assessment was named the McGill Ingestive Skills Assessment (MISA) and had 190 items in 7 scales. The Historical Risk Scale (57 items) included items from the patient's medical history that could contribute to the development of a swallowing disorder. The Mealtime Situation Scale (13 items) documented characteristics of the patient's environment which contribute to safe feeding. The Physical Characteristics Scale (30 items) addressed anatomical and physiological characteristics of the head and neck. The Texture Management Scale (11 items) addressed the foods that the patient is able to eat. Oral-motor and pharyngeal skills were assessed in the Solid and Liquid Ingestion Scales (37 and 16 items, respectively), and self-feeding skills and mealtime behavior were addressed in the Ingestive Ability Scale (26 items). It was decided that the scores from the scales should not be summed to give a composite score, because each scale represented a discrete facet of the construct of "ingestion." This first version was now ready for field testing.

Item Reduction

The goal of the first field test of the MISA was to examine item performance in order to reduce the number of items in the assessment. This process included a field test of the MISA, two stages of statistical analysis, and two meetings of a group of professionals to select items.

Subjects

Fifty subjects between 60 and 99 years of age were recruited so that the representation of each decade would be approximately equal (mean age 80.0 years, standard deviation 11.3 years). Twelve subjects each from the seventh and eighth decades of life and 13 each from the ninth and tenth decades were evaluated. Twenty-eight individuals resided in skilled nursing care facilities. These subjects were identified by the staff as having difficulty during mealtimes, with biting or chewing, requiring diets with modified food textures, having a history of recurrent pneumonia, choking, and having difficulty with self-feeding. Six subjects were living in supervised apartments affiliated with one of the nursing homes. These individuals were in declining health but had no known ingestive problems. They required minimal supervision and assistance by nursing staff in activities of daily living. Sixteen subjects were living in the community and were recruited through contact lists from a previous study of well elderly persons [29]. These individuals had no ingestive or health problems serious enough to require supervision. Written consent to participate was obtained from all subjects or their legally appointed guardian.

Table 2. Item development, selection and reduction

	A. Item development	B. Item reduction (i) First meeting	B. Item reduction (ii) Second meeting
Initial No. items	208 from literature	190 from first field test	63 from 1st meeting
No. items eliminated	110	127	15
Reasons for elimination	Did not obtain majority vote (107 items retained, 17 of which were absorbed into scoring; 5 appear twice in MISA)	61 medical history or physiology[a] 12 face validity 11 redundant 9 no variability 5 subjective 4 poor psychometrics 3 confounded	5 medical history or physiology 2 face validity 1 redundant 4 no variability 3 subjective
No. new items	110 (15 duplicated list items or were absorbed into scoring; 6 appear twice in MISA)	—	8
Reasons for addition	Majority vote by group on validity of new items, based on clinical experience	—	5 new items 3 face validity
Final No. items	190	63	50
Scoring	2, 3, 4, or 5 points	3, 4, or 5 points	4 points
Scales	Historical Risk Mealtime Situation Physical Characteristics Texture Management Solid Ingestion Liquid Ingestion Ingestive Ability	{eliminated} Mealtime Situation Physical Characteristics Texture Management Solid Ingestion Liquid Ingestion Ingestive Ability	Positioning {eliminated} Textures Solid Ingestion Liquid Ingestion Self-Feeding Skills

[a]Some items had more than one problem reported; all reasons for elimination were counted.

Sixty percent of the subjects had one or more medical conditions that could influence ingestion. Forty-six percent of the sample had dementia; 22% had a history of stroke; 6% had Parkinson's disease; and 6% had nonneurologic diagnoses. Forty percent of subjects had no diagnoses that could contribute to ingestive difficulties. None of the subjects was fed nonorally. Candidates were to be excluded if they had behavior problems related to mealtimes or if there was a congenital or acquired anatomic abnormality. There were no such referrals made to the study.

Data Collection

The principal investigator, two occupational therapists experienced in dysphagia evaluation, and one with no prior training in dysphagia participated in the data collection for this part of the study. The evaluators were trained during a 3-hour session. Each item on the MISA was explained and a videotaped meal was scored. The group discussed the scores chosen by each evaluator and the videotape was reviewed until full agreement was reached on each item. If there was a dispute about the correct scoring of an item, the principal investigator's rating served as the standard. The inexperienced therapist received further training by observing three assessments. She independently scored each subject and her results were compared with those of the principal investigator. During this time, additional explanation of the items was provided as indicated by difficulty with scoring the subject or by poor reliability. The inexperienced therapist began assessing subjects for the study only when she demonstrated an understanding of all test items and their clinical presentation.

All subjects were seen by two evaluators at either lunch or supper. The evaluators arrived before the meal was served and remained until the end of the meal as indicated by the consumption of all food, consistent food refusal, or the removal of the remaining food by the staff of the institution. Subjects requiring assistance were aided by their usual feeder. The evaluators were instructed not to interact with the feeder or the subject during the meal. They were seated so that they had approximately a semiprofile view of the subject. The assessment took no longer than the duration of the meal, which was less than 45 minutes for all subjects. A medical history was obtained for each subject either from the medical chart or by interview.

Analysis

The interrater reliability of each item was calculated using an unweighted kappa statistic between the raters. One of the two evaluations for each subject was selected at random for further analysis. The selected assessments were analyzed to obtain the frequency distribution of scores for each item, as well as means, Pearson product-moment correlations between items, between items and scales, and between the scales. The assessments were then stratified according to whether individuals resided in the community or in a nursing facility (a proxy for health status) and all frequency and correlation analyses were repeated for each stratum. This data is available from the authors upon request. Cronbach's alpha was calculated for each of the scales to allow examination of their internal consistency (Table 3). The number of subjects in the study was insufficient to permit factor analysis to confirm the as-

Table 3. Internal consistency of scales (Cronbach's alpha)

	After field test		After item reduction (B.ii)		After preliminary psychometric test		
Scale[a]	k[b]	alpha	k	alpha	k	alpha	New scale names
MSS	13	0.84	4	0.74	5	0.90	Positioning
TMS	11	0.42[c]	8	0.83	13	0.86	Textures
IAS	26	0.88	12	0.84	7	0.89	Self-Feeding
SIS	37	0.85	18	0.78	15	0.89	Solid Ingestion
LIS	16	0.88	8	0.84	10	0.91	Liquid Ingestion

[a]MSS, Mealtime Situation Scale; TMS, Texture Management Scale; IAS, Ingestive Ability Scale; SIS, Solid Ingestion Scale; LIS, Liquid Ingestion Scale. Alpha values for the HRS (Historical Risk Scale) and PCS (Physical Characteristics Scale) were not calculated due to their early elimination.
[b]k = number of items.
[c]Unscaled value; scaled value not available due to uniformity of scores on one or more items.

Table 4. Criteria for item selection

Property	Statistic	Criteria
Face validity	—	Judgment of expert panel
Sensitivity	Frequency distribution	Each scoring category used, different distributions for well and ill individuals
Redundancy	Interitem correlation	Item has correlation <0.80 with all other items
Item consistency, cohesiveness	Item–scale correlation (to all scales)	Item has positive correlation with all scales on the MISA
	Scale–item correlation (within own scale)	Number of items with correlation >0.50 with scale score

signation of items into scales. This type of analysis requires a minimum of 5 subjects for each item [30,31]. Cronbach's alpha was therefore selected as the optimal means of verifying scale assignment [30,31].

Focus Group Meetings

First meeting: A group of professionals was assembled to select items for the revision of the MISA based on the results of the field testing and the data analysis. This panel included the principal investigator; experts in the domains of ingestion (PhD, occupational therapist), test development (PhD, physical therapist), and statistics (PhD, statistician); and a speech-language pathologist experienced in clinical aspects of feeding intervention. At the opening of the meeting, the group discussed what the role of the MISA would be in the arsenal of assessment tools available to the clinician. This was necessary to ensure that each of the members had the same understanding of the purpose of the assessment. The panel then carried out an examination of each item's adherence to the goals of the assessment as well as its psychometric properties. Items that would require extensive training or that could not be observed at the bedside were removed from the assessment. Items that measured impairment rather than disability were also removed from the assessment (Table 2, B.i). This eliminated all items on medical history and physiology. These items performed poorly on two counts. First, they could only be scored as "present" or "absent," resulting in scales which were simply a listing of the individual's health problems rather than a coherent assessment of health status. Second, these items did not contribute to an assessment of function and so were inappropriate for inclusion. Preliminary decisions were made whether to retain or eliminate the remaining items based on ease of scoring, contribution to feeding difficulties, representation in the population, adherence to the goals of the measurement, and psychometric performance. The score distributions were examined for each item to determine if the distributions were appropriately weighted (i.e., concentration of high scores for well individuals, concentration of low scores for ill individuals). If consensus could not be reached, the item was retained for reconsideration at the second meeting. In all, 63 items were retained at the first meeting. Eighty-seven items were eliminated because they measured impairment and 42 items were eliminated on the basis of poor face validity or poor item performance during the preliminary testing. Items with poor face validity did not test an aspect of functional ingestion. Items with poor performance demonstrated a lack of variability in scoring, were difficult to score on observation, or otherwise performed poorly on psychometric tests.

Second meeting: Each member was given lists of retained and eliminated items, based on the decisions made at the first meeting. Each item's frequency distribution and interrater reliability (kappa) were presented. For retained items, information on the highest correlation with another item within the same scale, the name of the scale with which it had the highest correlation, and a list of items with which it had a correlation coefficient of >0.8 was also provided. For eliminated items, the reason for elimination was given. The criteria in Table 4 were used to refine choices made at the first meeting using these statistics. The performance of the items in distinguishing between individuals who were well and those in poor health was also examined. The group discussed the choices made at the first meeting, considering in particular the face validity of each item, its adherence to the goals of the assessment, and its psychometric performance.

Table 5. Characteristics of subjects[a] in the preliminary psychometric test

		Diagnosis[a]				
Age	*n*	Dementia	Parkinson's	Stroke	Psychiatric	Other
60–69	3	1	2	2	1	0
70–79	4	2	4	0	2	0
80–89	16	3	13	5	5	1 Trigeminal neuralgia 1 Bells palsy 1 Vitamin B12 deficiency
90+	10	5	10	2	2	1 Seizure disorder 1 Peptic ulcer

[a]Subjects may have more than one diagnosis.

Fifteen items were eliminated because they did not meet criteria for inclusion. These included the 4 items remaining in the Physical Characteristics Scale, and so this scale was eliminated. Three items were reinstated from those eliminated at the first meeting, as they were necessary to maintain the face validity of the scales. Five new items were added to improve the face validity of the Texture Management Scale. These were generated from the standard texture labels used by clinicians to describe aspiration-risk reduction diets for dysphagia [32]. Finally, the group discussed the number of scoring categories and the category labels for each item. It was decided that a 4-point scale would maximize the responsiveness of the tool and force a choice on either side of midrange ability. The principal investigator compiled the information from these meetings and independently revised the scoring categories.

The scores from the items that were retained were used to assemble a shortened profile for each subject. The psychometric properties of the revised version were estimated using the data from the shortened profiles and were compared to the properties calculated from the 190 items. Internal consistency (Cronbach's alpha) of the revised scales was good (Table 3, middle column). The Texture Management, Liquid Ingestion, and Ingestive Ability Scales on the revised version had $\alpha > 0.80$, which is adequate for clinical use. The Solid Ingestion Scale had an internal consistency approaching 0.8 when alpha was calculated using data from the first field test, and the Mealtime Situation Scale internal consistency was the poorest at <0.75.

The revised MISA consisted of 56 items in 5 scales, which were renamed to reflect the change in content subsequent to the item reduction (Table 2, B.ii). Positioning replaced the Mealtime Situation Scale, and described the elderly person's position during feeding and his/her ability to maintain an appropriate position. Textures replaced Texture Management Scale and is a list of all food and liquid consistencies that are routinely offered in dysphagia care [32]. Self-Feeding came from the Ingestive Ability Scale and describes the individual's ability to function independently during the meal. Solid Ingestion and Liquid Ingestion retained their names and continue to comprise items regarding oral-motor skills and observable signs of pharyngeal dysfunction.

Preliminary Psychometric Test

The revised MISA underwent a second field test on a small, independent sample in order to examine its psychometric properties prior to large-scale testing. This part of the study entailed descriptive statistical analysis and further item reduction.

Subjects

The revised MISA was administered to 33 residents of a single nursing facility who were reported by nursing staff to have difficulty with self-feeding, eating, or swallowing. All subjects were aged 60 or older (mean age 84.5 years, standard deviation 9.4 years) and had one or more neurological problems that could contribute to ingestive skill loss (Table 5). Thirty percent also had psychiatric diagnoses requiring medical intervention; these were predominantly schizophrenia or depression. The median number of medical conditions that influenced ingestion was 2. No individuals who were receiving nonoral feeding or who had anatomic abnormalities or behavioral problems were referred to the study.

Data Collection

All subjects were evaluated at either lunch or supper by the principal investigator, following the guidelines described above. The occupational therapist on staff had been instructed in the use of the MISA by verbal explanation of each item. During her training period, she assessed 5 subjects. The principal investigator provided an immediate review and explanation of each of the items and their scoring. At the fifth evaluation, the two evaluators attained 100% agreement when independently rating the subject, and the staff therapist reported that she was comfortable with the assessment. From this time on, she randomly selected 6 subjects to evaluate so that the interrater agreement of the test could be verified.

Analysis

The adequacy of each of the items was examined. Items that had correlations >0.80 with at least one other item on the assessment were identified. Each pair of redundant items was inspected and a judgment made whether to retain both items or eliminate one, based on knowledge of the relationship between the items' objectives. If the high correlation appeared spurious (i.e., no known relationship between the redundant characteristics having been published in the literature), both items were retained. If the items appeared to have a true redundancy, the item which was worded less clearly was eliminated.

After elimination of redundant items, further analyses were carried out on the remaining items. Frequency distributions for the scores on each item were constructed. Cronbach's alpha was cal-

Table 6. Pearson correlations between scales after preliminary psychometric testing

	Positioning	Texture	Self-Feeding	Solid Ingestion	Liquid Ingestion
Positioning	—				
Texture	0 45	—			
Self-Feeding	0.74	0.61	—		
Solid Ingestion	0.81	0.49	0.64	—	
Liquid Ingestion	0.62	0.51	0.73	0.64	—

Table 7. Interrater agreement after preliminary psychometric test

		Percent agreement			
Scale	No. items	Equal score	1 point diff.	>1 point diff.	Correlation
Positioning	5	80	8	12	0.95
Textures	13	93	0	7	0.97
Self-Feeding	10	67	21	12	0.92
Solid Ingestion	15	45	40	15	0.92
Liquid Ingestion	7	75	11	14	0.95

culated for each scale to determine its internal consistency. Percent agreement and Pearson's correlation coefficient were calculated using the MISA scores from individuals assessed by both raters ($n = 6$) in order to establish interrater agreement. The sample was too small to permit the use of a kappa statistic.

Results

After the preliminary psychometric test, 40 of the 56 items demonstrated no redundancy with any of the other items (interitem correlation <0.8). Sixteen items had correlations >0.8 with at least one other item. Of these, 6 were eliminated because the high correlations were due to redundancy in content. Ten items were judged to demonstrate spurious relationships and were retained.

The psychometric properties of the final version were calculated using the remaining 50 items. Twenty-nine (58%) items correlated more strongly with their parent scale than with any other scale. All scales were positively correlated with one another. Correlations between scales were generally below 0.80, with the exception of the correlation between the Position and Solid Ingestion scales (Table 6). Cronbach's alpha was also calculated for each scale (Table 3, last column). These values remained above 0.85 despite the extensive reduction in the number of items. The alpha statistics for the Position and Solid Ingestion Scales are above 0.9, and the Self-Feeding and Liquid Ingestion scales have $\alpha = 0.89$.

On all of the items, interrater agreement was very high. Each item for each of the 6 subjects was taken as an independent judgment and percent agreements between raters were calculated for each scale (Table 7). Overall, 68% of the judgments made by the raters agreed, 12% differed by one point, and 16% differed by two or more points. Correlation between raters was above 0.90 on all scales.

Discussion

This study represents a methodologically thorough approach to the development of a reliable and valid diagnostic tool. The development of items is a crucial step in the construction of a valid assessment tool. Several methods of accomplishing this task have been used. DeVellis [33] described the use of a literature review for generating items and subsequent voting on the items by a focus group. This method was selected for the present study. Streiner and Norman [34] described guidelines for assembling the group and conducting the meetings. These authors recommend that the focus group decide on the themes to be used in the assessment and then be involved with the selection and refinement of items once they have been written by the test developers [34]. This method can introduce bias if the evaluators represent a limited knowledge base. For this reason, practitioners from a variety of professions were involved in the development and selection of the items. These professions brought the necessary diverse perspectives to the selection and creation of items. The authors are confident that the items retained and generated at the focus group meetings covered the entire construct of

ingestive skill loss and that the exclusion of families from this process did not result in an omission of information. Furthermore, the patients targeted by the assessment would generally be unable to participate in such a group as a result of language impairment or cognitive deficit. It is unlikely that any systematic bias was introduced into this study as a result of the geographic proximity of the group members, as they had been trained in different institutions and followed different evaluation and treatment philosophies at their respective places of employment. This method allowed the development of items within the framework envisioned by the test developers. At the end of the item development process, enough items had been generated to satisfy the guideline of starting with double or triple the final number of items desired in order to achieve a sensitive and reliable assessment [35].

Diversity of diagnosis and functional performance is necessary for the development of a tool that is to be used for a wide range of abilities [36]. Subjects in the first field test were not selected by diagnosis to ensure that the tool will ultimately be useful for a wide variety of problems. Instead, they were selected so that a variety of problems and severity of feeding difficulty would be represented. The inclusion of a number of individuals with no known ingestive impairments ensured that the items included in the tool were able to distinguish between individuals who were functioning normally and those with minimal impairments. This will ultimately result in a more sensitive and reliable assessment tool [34].

Those items that could not be visually observed were recognized as being unmeasurable at the bedside, namely, pharyngeal function [37], bolus control, the competence of the swallow, and pocketing in the valleculae and pyriform sinuses [38]. They performed poorly during the first field test and generally did not meet the criteria for a measure of ability. They were eliminated from the MISA. These patient characteristics would be better tested by instrumental or neurological examination [39,40]. The importance of obtaining a medical history and assessing physiologic functions of the patient is indisputable. However, their inclusion in a bedside evaluation of ability is inappropriate because of the stated objectives and limitations of a bedside assessment.

The inclusion of impairment-based items in existing bedside assessments may have led to the argument that a bedside evaluation does not adequately measure aspiration risk [38]. However, many of the externally visible disabilities resulting from these impairments have scientific support as predictors of events in the pharyngeal stage of the swallow [14]. Behavioral manifestations of dysphagia are also similar across diagnoses [41]. It would therefore stand to reason that a carefully crafted assembly of observable signs of functional capacity may permit the clinician to predict physiologic events in a variety of swallowing problems. Further study will determine if the MISA permits clinicians to make reliable predictions regarding feeding safety, given that the assessment is formed only of such directly observable patient characteristics.

The number of items in the scales remains high. However, according to the analyses of Cronbach's alpha coefficient, further reduction in each of the scales would be detrimental to their internal consistency (data available from author upon request). In addition, it was the unanimous opinion of the second focus group that the high number of items was necessary to the face validity of the tool, as each measured distinct and clinically relevant skills. The number of items will be reverified on a new sample during the next stage of psychometric testing.

The number and labeling of scoring categories became more consistent through the evolution of the MISA. The guiding principle for selecting the number of levels in a categorical scale states that there will be a loss of information if the number of levels is less than the rater's ability to discriminate [34]. During the first field test, it quickly became evident that items scored on a 2-point scale were not sensitive to subtle differences in patient function. Three points were easily and reliably discriminated. On the other hand, raters had difficulty distinguishing between categories on a 5-point scale. A 4-point scale was eventually adopted in order to set an achievable standard of discrimination, forcing a choice to either side of a moderate level of disability and thus fostering increased reliability. As a result, it was decided not to put strong emphasis on kappa values during the item selection process because of the reorganization of scoring that needed to be done. A standardized list of category labels is available in the English language. These are known to be ordinal and demonstrate fairly equal intervals, which facilitates interpretation and statistical analysis [42,43]. In the revised MISA, these labels were used as widely as possible. With these changes, the reliability of the items was at an acceptable level as evidenced in the preliminary psychometric test.

The psychometric properties of the revised MISA indicate that the scales are approaching published standards of scale and item cohesiveness for screening, goal setting, and monitoring [34]. Levels of

correlation of the items to each other and to the scales and between the scales should be set *a priori* by the test developers [44]. For the MISA, target values between 0.3 and 0.8 were sought. As suggested by Green and Lewis [44], more consideration is necessary than just the interitem and item-total correlations. By setting these high standards, only items with severe redundancy would be eliminated. This strategy left behind those items that were similar to, but not redundant with, others to be considered under the additional criteria presented in Table 3. The correlation above 0.80 found between the Positioning and Solid Ingestion Scales suggests redundancy and will be closely examined following future psychometric testing. At this time, the decision was made to keep all 5 scales despite the high interscale correlation in order to permit reanalysis on a larger sample. Positioning is a distinct domain that is amenable to modification separate from the treatments offered for loss of oral-motor skills for solid ingestion. Therefore, the inclusion of both scales should strengthen the assessment. A study of the assignment of items into the scales using factor analysis would also clarify this issue.

The internal consistency of the scales has improved throughout the item reduction process. Only the Textures scale has $\alpha < 0.89$. This result was expected, as this scale combines items regarding the acceptance of different liquid and solid textures, which are not necessarily interrelated. Therefore, the consistency of all scales may be considered adequate. The interrater agreement was excellent, with the raters demonstrating correlations on scale scores ≥ 0.92 on all scales and with $\geq 85\%$ of scores on each scale being scored within one point. The preliminary psychometric test did not aim to definitively establish the properties of the MISA, rather, it served to justify the planning of a large-scale test. The authors are confident that the preliminary results show promise of the MISA's reliability and validity. Further revision of the assessment will be undertaken should large-scale testing demonstrate poor performance of certain items or scales.

The validity of the MISA has not yet been thoroughly tested. At this time we are able to conclude that the assessment has adequate face and content validity, as determined by the focus group and the panel of experts involved in the development process. Construct validity was established during the item reduction process, when items were chosen based on their ability to discriminate between well and ill individuals (i.e., known group validation). Criterion, concurrent, and predictive validation of the MISA will be undertaken in future studies.

In terms of limitations, the reader must keep in mind that this article outlines the preliminary testing of the assessment tool that is being used to justify further testing of the assessment. As such, the sample size is too small to permit conclusions regarding the reliability and validity of the assessment. The MISA shows indications of adequate psychometric properties and meets the criteria set forward by both Streiner and Norman [34] and Nunnally and Bernstein [30]. Certain psychometric properties, most notably responsiveness, have not yet been explored. This work will be undertaken in future studies. Although the participants included in this study have been recruited from a limited number of nursing facilities and community resources, these are representative of both the age range and diagnostic groups making up the projected population to which the assessment will be applied. Efforts were made to include participants with a wide variety of feeding ability so that the ceiling and floor effects of the items and the scales could be examined. The forthcoming trials of the assessment will be carried out on a large sample in a greater number of facilities, thereby allowing the final results to be generalized to a larger population.

The most novel aspect of the MISA is its emphasis on ability rather than impairment as defined by the World Health Organization [27,28]. The medical model dictates that health professionals seek out the reasons for a difficulty, that they assess physiologically, and treat accordingly. The individual's ability to function on a daily basis, and in a social framework, is not included in this model. Rather, the emphasis of the medical model is on the biological organism and physiological function. The International Classification of Impairments, Disabilities and Handicaps (ICIDH, ICIDH-2) provides a framework for functional diagnosis and goal planning by rehabilitation experts [45]. In rehabilitation, evaluation of an individual's skills can have greater clinical relevance than measures of their physical impairments because the goals of rehabilitation are then formulated and measured from the perspective of function [46,47]. To address the individual's ability, the "ability (or disability) measure" should correspond to socially important patterns of function [48], outside of the therapeutic setting [49]. This assists in the determination of clinically important change in function and the generalization of improvements as a result of rehabilitation [49].

The MISA strives to meet the goals of an ability assessment. It has passed the first of many hurdles in its path to becoming a clinically useful measure. It is not intended to replace instrumental

assessments, as their strengths and limitations are well documented [12,13]. However, as the limitations of existing assessments are explored, the necessity of having a variety of tools at one's disposal is becoming more evident [15]. We now know that some individuals, especially those with cognitive loss, are not good candidates for rehabilitation with the goal of ameliorating impairment, but maintaining or maximizing their functional abilities by other means can still be anticipated [50]. The MISA will be useful for assessing individuals whose functional skills or behavior put them at risk for ingestive problems, whose physical or mental state prohibits the use of an instrumental assessment, or whose abilities can be maximized through conservative management techniques.

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Appendix: Definition of Scales and Sample Items

Abstracted from the McGill Ingestive Skills Assessment User's Manual, Draft Version 2.

For ease of reading, the following text uses the male gender to refer to male or female patients.

Positioning

The purpose of the Positioning Scale is to assess the patient's ability to maintain a position that is safe for feeding. The observer should not alter the patient's position during the meal; this task should be left to the regular caregiver or the patient himself.

Maintains Symmetry of Posture

For this item, observe whether or not the patient leans to the right or the left during the meal.

Score 1 if the patient spends all or nearly all of the time leaning to one side and does not straighten himself even when he is taking a new mouthful or when he is are swallowing.

Score 2 if the patient spends more than half of the meal leaning to one side. The patient may lean from time to time and then reposition or may lose his position after a few minutes of the meal and does not regain a symmetric posture.

Score 3 if the patient spends about less than half of the meal leaning to one side. The patient may lean from time to time and then reposition or may lose his position partway through the meal and does not regain a symmetric posture.

Score 4 if the patient is able to maintain a symmetrical posture or if he adopts an asymmetric position only transitionally. The patient should be symmetric when taking a mouthful or swallowing. If he is not, score 2 or 3 as appropriate. Some individuals habitually shift their weight from side to side; if they come back to the centre, score 4.

Has Adequate Head Control for Feeding

For this item, observe the patient's ability to hold his head in a neutral position. During eating, the neck should not be extended or flexed more than a few degrees, so that the chin is tucked in.

Score 1 if the patient requires a head support to prevent loss of position or if he is never able to hold his head in a stable position.

Score 2 if the patient is able to bring his head into a neutral position and maintain it for a few seconds but does not have head control for the majority of the meal.

Score 3 if the patient is able to maintain his head position for the majority of the meal duration but has occasional loss of control, allowing his neck to flex or extend.

Score 4 if the patient is able to maintain his head position throughout the meal. Some individuals may voluntarily look around the room or voluntarily flex or extend to relax stiffness; these individuals should also be scored 4 if these movements are voluntary. If there are involuntary movements in addition to these, score 2 or 3 as appropriate.

Texture Management

The purpose of the Texture Management Scale is to assess the individual's ability to accept food textures. The purpose is not to assess the safety of the consumption of these textures; that aspect is addressed later. In this scale, we are assessing the individual's judgment, discretion, and sensitivity to different textures.

Each of the items is prefaced by the word *accepts*. This word is to be interpreted as the willing consumption of the texture described. If an individual does not accept the food, he may turn away or refuse to open the mouth. Some individuals realize that they are unable to handle a texture only when it is in the mouth. If an individual spits out a food, appears anxious, cries, or otherwise demonstrates hesitancy or resistance to swallowing, this should be interpreted as not accepting the texture. Some individuals may take a mouthful and then refuse to eat any more; this should be interpreted as nonacceptance unless the patient makes a statement that he dislikes the taste of the food.

Feeding Skills

The purpose of this scale is to assess the individual's ability to manage the meal activity independently and functionally. The scale touches on various aspects of meals, including preparation, self-feeding, behavior, judgment, and appetite.

Sets Up Tray Independently

This item is concerned with the patient's ability to arrange platters appropriately on the tray or table, open wrappers, remove lids, and prepare utensils.

Score 1 if the patient requires someone else to carry out all or part of these tasks.
Score 2 if the patient is able to carry out the tasks independently if he is given precise verbal instructions ("pick up the crackers, hold the plastic in each hand, and pull") or if he is given a physical demonstration without the helper doing the task for him.
Score 3 if the patient needs only a verbal prompt ("the butter for your bread is on the tray").
Score 4 if the patient is able to complete all tasks without assistance or prompting.

Able to Grasp Utensil Functionally

For this item, observe how the patient holds the utensil. The style of grasp is not important. Rather, the utensil should be held in such a way as to prevent spillage of the food before the utensil reaches the mouth.

Score 1 if the patient is fed by an assistant or if he almost never grasps the utensil functionally.
Score 2 if the patient self feeds and grasps the utensil functionally for less than half of the meal.
Score 3 if the patient self feeds and holds the utensil functionally for more than half of the meal.
Score 4 if the patient always uses a functional grasp.

Liquid Ingestion

The purpose of this scale is to assess the patient's ability to consume regular and thickened liquids. The scale should be scored whether the patient takes the liquid from a glass, cup, or spoon. The scale addresses the various motor functions associated with drinking and the observable signs of pharyngeal function and airway protection.

Seals Lips on Cup

This item addresses the patient's ability to close his lips on the cup when he drinks. Observe the closure of the lips with particular attention to the bottom lip. The glass or cup should rest on the bottom lip during drinking, and the upper lip should close towards the inside of the glass. Some individuals do not completely oppose the upper lip to the surface of the cup; this is considered normal.

Score 1 if the patient almost never closes his lips on the cup. This may be seen by stabilization of the glass on the lower teeth and/or a lax lower lip. Score 2 if the patient takes liquids from a spoon.
Score 2 if the patient closes his lips on the cup less than half of the time. He may stop closing his lips partway through the meal or close them only on occasion throughout the meal.
Score 3 if the patient closes his lips on the cup more than half of the time. He may stop closing his lips partway through the meal or close them only on occasion throughout the meal.
Score 4 if the patient closes his lips consistently for the entire meal.

Demonstrates Same Voice Quality After Drinking

This item assesses the patient's ability to protect the airway from penetration of liquid. The presence of aspiration and penetration is associated with a change in the patient's voice. A hoarse voice generally becomes deeper and takes on a rough quality. A gurgly voice can be described as sounding "well," as if there is liquid on the vocal cords. The patient should be observed throughout the meal to determine if this phenomenon appears with fatigue.

Score 1 if the patient loses his voice after drinking or if he is unable to verbalize at the outset of the meal. A loss of voice on one occasion without any other abnormalities is scored 1.
Score 2 if the patient demonstrates a change in voice after drinking a small quantity of liquid or if this occurs near the beginning of the meal.
Score 3 if the patient demonstrates a change in voice after drinking a large quantity of liquid or if this occurs near the end of the meal.
Score 4 if there is never any change in voice after drinking.

Solid Ingestion

The purpose of this scale is to assess the patient's motor skills for eating, as well as to evaluate the observable signs of pharyngeal dysfunction. The patient should be observed as he consumes all foods of a solid texture, including purees and puddings.

Opens Mouth in Anticipation

This item assesses the patient's preparation to receive food. The patient should open his mouth to admit the utensil whether he is being fed or is self-feeding. The patient should open at the sight or smell of the food approaching, on a verbal cue from a feeder, or, in the case of individual with multiple sensory deficits, as the utensil is touched to the lower lip. Unless there is a physical limitation to the range of motion in the jaw, the mouth should open wide enough to allow the utensil to pass without stretching the corners of the mouth.

Score 1 if the patient almost never opens his mouth in anticipation. If the patient needs to be coerced to open his mouth or consistently opens his mouth so little that the utensil cannot pass, score 1.
Score 2 if the patient opens his mouth less than half of the time or opens his mouth widely enough only on occasion.
Score 3 if the patient opens his mouth more than half of the time or only occasionally does not open widely enough for the utensil to pass.
Score 4 if the patient consistently opens his mouth widely enough in anticipation.

Retains Food in Mouth

This item assesses the patient's ability to form a bolus and control the bolus in the mouth, as well as the ability of the lips to contain solid food. This should be scored based on the patient's performance throughout the processing of the bolus in preparation for the swallow.

Score 1 if the patient loses any amount of food on a consistent basis or if there is occasional loss of large quantities of the bolus.
Score 2 if the patient loses small amounts of food frequently. This may occur at intervals throughout the meal or begin to occur consistently as the patient becomes fatigued as the meal progresses.

Score 3 if the patient loses small quantities on occasion, either periodically throughout the meal or consistently for a short period of time.
Score 4 if the patient never loses food during oral processing.

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