Original Research

Impact of Dysphagia Severity on Clinical Decision Making via Telerehabilitation

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Abstract

Objective: *Recent research supports the proposal that valid and reliable clinical swallow examinations (CSEs) can be conducted via telerehabilitation. However, no studies have explored whether dysphagia severity has an impact on the success of the session or its outcomes. The current study examined how dysphagia severity impacted on either (a) clinical decision making for safety of oral intake or (b) clinician perceptions of CSEs conducted via telerehabilitation.* ***Subjects and Methods:*** *One hundred patients (25 nondysphagics and 25 mild, 25 moderate, and 25 severe dysphagics) were assessed using a telehealth system and methodology reported in prior research. For each assessment, the online and face-to-face (FTF) clinicians simultaneously completed a structured CSE. On session completion, the online clinician indicated level of agreement with two statements regarding the level of rapport and ability to competently assess the patient.* ***Results:*** *In each of the four groups, acceptable levels of agreement were observed between raters for the three primary outcomes (decisions regarding oral/nonoral intake and safe food and fluids) as well as over 90% of the CSE items. Clinicians agreed they could develop good rapport with the majority of patients in all groups. However, for a small but significant ($p < 0.5$) proportion of patents in the severe dysphagic group, clinicians disagreed they were able to satisfactorily and competently assess to the best of their abilities using the telerehabilitation system.* ***Conclusions:*** *Clinical decisions made during and as an outcome of the total CSE were found to be comparable to those made in the FTF environment regardless of dysphagia severity. Clinicians noted some difficulty assessing patients with greater complexity, which occurred in greater numbers in the group with severe dysphagia.*

Key words: *deglutition and deglutition disorders, telerehabilitation, dysphagia, swallowing disorders, aspiration, clinical swallowing examination, videoconferencing*

Introduction

Dysphagia is a highly prevalent condition that can occur in a wide range of clinical populations.[1–3] Without appropriate assessment and management, the presence of dysphagia can lead to serious adverse health outcomes, including aspiration pneumonia, which can contribute to patient morbidity and mortality.[4–6] It is well recognized that the presence of dysphagia has a negative impact on quality of life and contributes to significant medical and broader socioeconomic costs.[4–7]

Speech language pathologists (SLPs) are responsible for the assessment and management of patients with dysphagia. The diagnostic process involves an initial clinical assessment, often referred to as a clinical swallow examination (CSE), followed by further detailed instrumental diagnostic assessments as required. The clinical objectives of the initial CSE are to identify those patients at risk of aspiration, to determine what food and fluids they can safely manage orally, and to initiate referral for further testing if warranted. Although it is recognized that CSEs can produce false-positives and lack the sensitivity to detect silent aspiration,[8,9] the CSE remains the clinician's primary initial tool in the process of dysphagia assessment and diagnosis.[10]

Although early diagnosis and intervention are recognized as integral to reducing dysphagia-related patient morbidity and mortality,[11–13] there are multiple challenges impacting the provision of timely and equitable dysphagia services. Although not an exhaustive list, key issues impacting services globally include remoteness, distance, access, lack of skilled professionals, paucity of local and specialist services, and increasing population demands. Hence finding new ways to enhance patient access to speech pathology services for dysphagia management is a current challenge.[14]

In response to this issue, there has been increasing interest in the potential of telerehabilitation to help improve access to both clinical and instrumental dysphagia assessment services.[15–21] In particular, there exists a small but emerging evidence base to support the validity and reliability of conducting a CSE via specialized telerehabilitation systems.[15–18] The first studies in this area used laryngectomy patients[17,18] and standardized patients[15] to confirm feasibility and refine the telesystem design. Following the positive results reported by those trials, the system was then tested with a cohort of 40 patients with mild to moderate dysphagia.[16] Results revealed that decisions made online regarding safety for oral intake, safe food and fluids, and the majority of other parameters examined via the online CSE were comparable to those made in the face-to-face (FTF) environment.[16] Studies emerging from this work have also reported that patient satisfaction with receiving dysphagia

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assessments via telerehabilitation is high.[22] Although such early support for CSEs delivered via telerehabilitation is positive, there remains a need for further research to fully understand the strengths and possible limitations of conducting CSEs online. In particular, the potential impact of dysphagia severity on the ability to complete the CSE and reach comparable clinical decisions to the FTF environment regarding safety for oral intake has not yet been investigated.

It is possible that severity may impact decision making in various ways; for example, mild deficits may be less obvious and potentially more difficult to detect via telerehabilitation. Alternatively, it is possible that clinicians may experience greater difficulty making decisions regarding the safety of oral feeding when assessing more severe patients in this modality. In other areas of telerehabilitation research, such as the assessment of aphasia, severity has been found to increase the challenges of conducting the online assessment.[23] Hence the aim of this study is to examine whether dysphagia severity impacts on either (a) clinical decisions regarding safety for oral intake and/or (b) clinician perceptions of developing rapport and performing CSE assessments via telerehabilitation. This information is necessary to help guide future clinical implementation of online dysphagia assessments.

Subjects and Methods

One hundred patients were recruited from the speech pathology department of the Royal Brisbane and Women's Hospital, Brisbane, QLD, Australia. Dysphagia status was determined from a CSE conducted by their current treating clinician (independent to the study) within 24 h prior to the online assessment. Severity was classified using the clinical descriptors of dysphagia severity from the Dysphagia Outcome and Severity Scale (DOSS),[24] a validated swallow severity rating scale. For inclusion, participants had to be deemed suitable for assessment by their treating medical officer and capable of remaining in a semi-upright or upright position for the duration of the assessment. There were no other exclusion criteria. Participants were not required to have any knowledge or skills associated with computers or technology. Eligible participants were initially stratified by dysphagia severity, and then secondary stratification was undertaken to equalize groups across age gender, etiology (acute/degenerative disorder, cancer care, or other), and cognitive status (determined from medical records as no impairment or impairment) to create four matched groups containing 25 nondysphagic patients (DOSS level 6–7), 25 mild dysphagics (DOSS level 5), 25 moderate dysphagics (DOSS levels 3–4), and 25 severe dysphagics (DOSS levels 1–2). Demographics of the 100 participants are detailed in *Table 1*. All participants provided individual consent. The study was granted ethical clearance from the Human Research Ethics Committees of both Queensland Health and The University of Queensland.

ONLINE AND FTF SLPS

Two SLPs from a pool of four with experience managing dysphagia in the acute-care setting served as either the online or FTF assessor for any assessment session. As interjudge reliability for aspects of the CSE has been reported to be variable,[25] prior to commencing the study, reliability training was conducted in the FTF environment by having these clinicians, in pairs, simultaneous assess 7–10 dysphagic patients. Clinicians simultaneously completed FTF assessments of patients, using the same CSE proforma as later used in the online assessments. After each assessment, any areas of disagreement on the proforma were discussed. Training took place over a period of 1–2 weeks and continued until all clinicians consistently achieved >80% agreement (>80% exact agreement for ordinal scale items, >80% close agreement for interval scale items) for ratings of patient suitability for oral/nonoral intake, safe fluid consistency, and safe food consistency and 80% agreement for at least 90% or more of the remaining items on the CSE proforma.

Before each telehealth assessment, two SLPs were randomly assigned their role (either online or FTF). The online SLP led the CSE for all assessments. The FTF clinician was located in the room with the

Table 1. Participant Demographics

GROUP	AGE (YEARS)	GENDER [*N* (%)]	ETIOLOGY [*N* (%)]	COGNITION [*N* (%)]
Nondysphagic	63 (27–86)	13 (52%) male	Acute/degenerative neurological: 15 (60%)	20 (80%) WNL
			Cancer care: 4 (16%)	
			Other: 6 (24%)	
Mild	70 (26–97)	13 (52%) male	Acute/degenerative neurological: 12 (48%)	17 (68%) WNL
			Cancer care: 6 (24%)	
			Other: 7 (28%)	
Moderate	71 (27–112)	12 (48%) male	Acute/degenerative neurological: 12 (48%)	22 (88%) WNL
			Cancer care: 10 (40%)	
			Other: 3 (12%)	
Severe	62 (21–85)	16 (64%) male	Acute/degenerative neurological: 12 (48%)	16 (64%) WNL
			Cancer care: 11 (44%)	
			Other: 2 (8%)	
Statistic	$F=1.59$, $p=0.20$	$\chi^2=1.45$, $p=0.69$	$\chi^2=8.53$, $p=0.20$	$\chi^2=4.85$, $p=0.18$

WNL, within normal limits.

patient and assessed the patient simultaneously with but independently of the online SLP to control for data error created by possible patient variability.[26] The alternate model of sequential/serial assessments was not considered appropriate as several patient-related issues, such as known swallow-to-swallow variability[27] and fatigue, could potentially influence the results if using a sequential assessment methodology.[26] Simultaneous assessment was also considered the preferred ethical model as a sequential methodology would have required repeated trials of consistencies known to create aspiration, hence increasing patients' exposure to aspiration. It is, however, acknowledged that a simultaneous assessment method can also introduce bias as the FTF clinician has the benefit of his or her own observations plus the observations of the interactions of the online clinician. As an acknowledgment of this, the online clinician was asked not to verbalize clinical decisions to minimize potential bias. Similarly, the FTF SLP did not communicate with the online clinician. The FTF clinician was free to move around the room to get close-up views (e.g., of the oral cavity or of readings from the finger pulse oximeter) when patients were performing tasks. Any necessary physical contact between the FTF clinician and the patient (e.g., to assess jaw muscle strength) was completed after the online SLP's assessment of that parameter.

ASSISTANT

As described in prior studies,[15,16,28] an assistant was also involved at the patient end. This professional was an allied health assistant (Technical and Further Education Level IV Certificate in Allied Health Assistance; HLT424507) working in a cognate field who had no prior understanding of dysphagia or its assessment. Prior to participation, the assistant received basic training to orientate to the swallowing assessment process, the tasks to complete during the sessions, and use of the telerehabilitation system. The assistant was responsible for setting up the system, positioning and preparing the patient, assisting with physical tasks (e.g., feeding the patient during the food and fluid trials), repeating instructions, and providing live demonstrations (for patients with significant visual or auditory deficits), under the direction of the online clinician. The assistant did not work independently or make diagnostic decisions.

THE TELEREHABILITATION SYSTEM

The telerehabilitation system was identical to that described in detail in earlier studies.[15,16] In summary, it consisted of notebook computers at the patient and clinician end that incorporated custom videoconferencing software with high-quality audio and video compression technology for real-time videoconferencing. At the patient end, the system was configured such that the patient did not control any aspects of the technology. A free-field combined echo canceling microphone and Web-conference speaker allowed general communication between sites, and a lapel microphone clipped to the patient's collar was used to detect subtle changes in voice quality. Fixed and free-standing cameras (with zoom capacity) were incorporated and remotely controlled by the online SLP. Split screen views allowed images of the online clinician and patient to be displayed simultaneously at both ends. Custom-built software captured audio and video (640 × 480 pixels) for store-and-forward recordings of the sessions. An *ad hoc* 802.11g wireless network with a throttled bandwidth of 128 kilobits/s was used for communication. The low bandwidth was purposefully chosen as it is the minimum bandwidth available across Australia's public health network.

THE CSE

As detailed elsewhere,[15,16] some modifications were made to the CSE administration process to assist the online clinician, including use of multiple camera positions and zoom settings, clear plastic feeding utensils and cups to optimize visualization of bolus timing/delivery/size, a finger pulse oximeter (model MD300C; GE, Melbourne, VIC, Australia) to monitor oxygen saturation levels and indicate any decline in patient status that may suggest need to cease the assessment, and a strip of white surgical tape positioned over the patient's thyroid notch to enhance visualization of laryngeal movement during the swallow.

The CSE followed a structured proforma of 65 test items divided into four main sections including (1) general orientation and alertness, (2) oromotor and laryngeal function assessment, (3) performance during food and fluid trials, and (4) clinical decisions and recommendations. Full details of the items have been reported elsewhere.[16] Items in each section were rated using either a 5-point severity scale rating (from 1 = normal function to 5 = severe impairment, minimal ability to complete inability to complete task) or by dichotomous/forced choice ratings (e.g., dentures: present/absent).

THE ASSESSMENT PROCEDURE

Patients were booked into a weekly telerehabilitation clinic in 1-h appointments (maximum of 4 patients per week). The online CSE assessment took an average of 45 min to conduct. For each clinic, the online clinician was located in one room of the clinical setting, whereas the patient, assistant, and FTF clinician were located in a second room within the same department. Both rooms were standard clinical consulting rooms with no special lighting or sound dampening modifications. Prior to the session, both the online and FTF clinicians received only the patient's relevant medical history, excluding any details of prior swallowing assessments. This documentation was prepared by the treating SLP who was uninvolved in the research. This ensured the assessing clinicians were blinded to the patient's prior swallowing status. For patient safety, the FTF clinician had the ultimate clinical responsibility and could cease the assessment at any stage. This was not required for any patient. In each assessment, the online SLP-based his or her clinical judgments on the online observations and/or on immediate (in session) review of the store-and-forward video files. Store-and-forward footage could be sent to the online clinician, on demand as required, during the session to allow review of the most recent task or tasks. This was used in less than 5% of cases when occasional audio delays or image pixilation caused difficulty rating the patient's function during the live interactions.

CLINICIAN QUESTIONNAIRE

On session completion, the online clinician completed a non-validated, eight-item satisfaction questionnaire used previously in prior research on telerehabilitation assessments of swallowing.[16] Only two of these questions, "I am happy with the level of patient–clinician rapport generated during this session" and "I feel that I was able to satisfactorily and competently assess the patientt to the best of my abilities using the system," were examined in the current study. Responses were rated on a 5-point scale (from 1 = strongly disagree to 3 = unsure to 5 = strongly agree).

DATA ANALYSIS

The primary outcomes of interest were the levels of agreement for the parameters of (a) patient suitability for oral/nonoral intake, (b) safe fluid consistency, and (c) safe food consistency. Levels of agreement for the other CSE parameters were considered secondary outcomes. Levels of agreement between the online and the FTF clinician for each severity group, across the 65 CSE parameters, was calculated using either (a) percentage exact agreement (PEA) for those nominal or categorical parameters or (b) calculating both PEA and percentage clinical agreement (PCA) (where ± 1 scale level difference on a 5-level scale is considered agreement) for ordinal data (e.g., 5-point rating scales). A level of ≥ 80% PEA (for nominal data) or PCA (for ordinal data) was used to represent clinically acceptable levels of reliability or agreement, as per prior research.[15–18,23,29–32] A secondary level of analysis, using quadratic weighted kappa values, was also calculated and interpreted using the level of agreement criteria set by Landis and Koch[33] (0.0–0.2, slight; 0.2–0.4, fair; 0.4–0.6, moderate; 0.6–0.8, substantial; 0.8–1.0, almost perfect). In prior research, inter-rater agreement for the majority of CSEs tasks rated by clinicians in the FTF environment has been reported to fall between 0.6 and 1.00.[25] Hence, the level of agreement expected between the decisions made between the online and FTF raters was set at ≥ 0.6. It has been reported previously that the quadratic weighted kappa statistic can produce a paradoxical result if the data's margin totals are highly symmetrically unbalanced, and as such they should not be reported alone.[34,35] Hence, where there was discrepancy between methods of analysis, the PEA/PCA data were used. Results of the clinician perceptions were compiled descriptively and then analyzed using the Kruskal–Wallis test with *post hoc* tests to explore differences between groups. Significance was set at $p < 0.05$.

Results

Levels of agreement for the CSE parameters rated within each severity group are displayed in *Tables 2–4*. Ratings of orientation,

Table 2. Levels of Agreement for Orientation and Oromotor Tasks

	NONDYSPHAGIC			MILD			MODERATE			SEVERE		
CSE ITEM	PEA	PCA	KAPPA	PEA	PCA	KAPPA	PEA	PCA	KAPPA	PEA	PCA	KAPPA
Orientation and alertness												
Alertness	100	NA	1.00	100	NA	1.00	100	NA	1.00	100	NA	1.00
Comprehension	96	NA	0.31[a]	100	NA	1.00	100	NA	1.00	100	NA	1.00
Oromotor function												
CNV	100	100	1.00	96	100	0.94	96	100	0.94	80	100	0.85
CNVII	69	97	0.76	76	100	0.84	90	100	0.85	69	96	0.88
CNIX–X	83	97	0.56[a]	82	100	0.85	84	100	0.82	68	98	0.85
CNXII	67	98	0.61	70	96	0.68	86	99	0.88	63	95	0.86
Oral hygiene and dentition												
Dentition	100	NA	1.00	100	NA	1.00	100	NA	1.00	100	NA	1.00
Dentures	72[b]	NA	0.80	80	NA	0.82	92	NA	0.88	100	NA	1.00
Denture fitting	100	NA	1.00	96	NA	0.99	92	NA	0.99	96	NA	0.99
Hygiene	88	NA	0.73	88	NA	0.75	72[b]	NA	0.27[a]	92	NA	0.83
Oral sores/ulceration	96	NA	0.86	100	NA	1.00	96	NA	0.86	96	NA	0.83
Pooling secretions/saliva	100	NA	1.00	96	NA	0.65	92	NA	0.63	88	NA	0.73

[a] < 0.6 kappa.

[b] < 80% criteria.

CSE, clinical swallow examination; NA, not applicable to calculate percentage clinical agreement (PCA) as the parameter represents nominal data; PEA, percentage exact agreement.

Table 3. Levels of Agreement for Food and Fluid Trial Clinical Swallow Examination Ratings Across Severity Groups

CSE ITEM	NONDYSPHAGIC			MILD			MODERATE			SEVERE		
	PEA	PCA	KAPPA	PEA	PCA	KAPPA	PEA	PCA	KAPPA	PEA	PCA	KAPPA
Fluid trials												
Anterior spillage	98	100	0.66	96	98	0.74	100	100	1.00	89	100	0.37[a]
Oral pharyngeal transit	86	98	0.09[a]	80	96	0.18[a]	95	100	0.88	61	100	0.62
Delay in pharyngeal swallow	92	100	−0.03[a]	90	100	0.75	93	100	0.85	54	89	0.17[a]
Number of swallows	76	96	0.30[a]	82	100	0.73	89	98	0.86	63	96	0.83
Laryngeal elevation	92	NA	0.31[a]	100	NA	1.00	98	NA	0.00[a]	100	NA	1.00
Wet voice	86	NA	−0.06[a]	100	NA	1.00	100	NA	1.00	89	NA	0.70
Oral pooling/residue	100	100	1.00	100	100	1.00	100	100	1.00	91	98	0.46[a]
Volitional cough	98	100	0.79	94	100	0.54[a]	96	100	0.89	89	100	0.78
Clearing throat	88	100	0.55[a]	100	100	1.00	96	100	0.88	93	100	0.85
Food trials												
Anterior spillage	100	100	1.00	100	100	1.00	100	100	1.00	97	100	0.79
Oral pharyngeal transit	50	93	0.66	76	100	0.83	87	100	0.92	71	94	0.64
Delay in pharyngeal swallow	86	100	−0.07[a]	96	100	0.65	94	100	0.78	77	97	0.54[a]
Number of swallows	38	79[b]	0.11[a]	65	98	0.51[a]	89	100	0.93	74	97	0.80
Laryngeal elevation	100	NA	1.00	100	NA	1.00	98	NA	0.00[a]	100	NA	1.00
Wet voice	100	NA	1.00	98	NA	0.00[a]	96	NA	0.65	100	NA	1.00
Oral pooling/residue	76	100	0.68	90	100	0.85	89	100	0.82	81	97	0.68
Volitional cough	95	100	−0.02[a]	100	100	1.00	91	100	0.61	94	100	0.82
Clearing throat	88	100	0.72	98	100	0.79	91	100	0.56[a]	97	97	1.00

[a] < 0.6 kappa.

[b] < 80% criteria.

CSE, clinical swallow examination; NA, not applicable to calculate percentage clinical agreement (PCA) as the parameter represents nominal data; PEA, percentage exact agreement.

alertness, and oromotor function reached acceptable PEA/PCA levels for all parameters across each severity group except for two parameters (assessment of denture status in the normal group and oral hygiene rating in the moderate group) (*Table 2*). For three parameters, kappa values fell below 0.6; however, because of known issues with kappa calculations[34,35] these were discounted as the PEA/PCA data confirmed high agreement. For the food and fluid trial items (*Table 3*) all parameters across all four severity groups met PEA/PCA criteria except for one parameter (number of swallows) in the nondysphagic group. Numerous kappa values were below 0.6; however, again, as the PEA/PCA data for these parameters were high and confirmed agreement, these were discounted. Regarding clinical decision and recommendations (*Table 4*), two parameters (need for referral in both the nondysphagic and mild dysphagic groups) failed to reach PEA/PCA criteria. Five kappa values in *Table 4* fell below 0.6; however, these results were not consistent with the high agreement confirmed by the PEA/PCA data.

Kruskal–Wallis analysis revealed no significant difference among groups regarding development of rapport (*Table 5*). For all groups, clinicians agreed or strongly agreed that they achieved adequate rapport for the majority of patients across all severity groups. However, they did feel there was a significant ($p < 0.05$) difference in their ability to assess patients to the best of their abilities across the groups (*Table 5*). *Post hoc* analysis revealed there was a significantly lower level of agreement between the severe dysphagic group and the other three groups (nondysphagics, $z = 2.92$, $p = 0.003$; mild dysphagics, $z = 3.51$, $p = 0.001$; and moderate dysphagics, $z = 3.65$, $p = 0.0003$). Subanalysis of the patients rated as not satisfactorily and competently assessed online revealed issues relating to low/soft vocal quality, which made assessment of voice and voice quality post-

Table 4. Levels of Agreement for Clinical Decisions and Recommendations

CSE ITEM	NONDYSPHAGIC			MILD			MODERATE			SEVERE		
	PEA	PCA	KAPPA	PEA	PCA	KAPPA	PEA	PCA	KAPPA	PEA	PCA	KAPPA
Decisions and recommendations												
Oral/nonoral	100	NA	1.00	100	NA	1.00	100	n/a	1.00	96	NA	0.91
Diet decision												
Fluids	100	100	1.00	100	100	1.00	100	100	1.00	92	100	0.91
Food	84	100	0.90	92	100	0.94	96	100	0.97	96	100	0.97
DOSS	68	100	0.90	92	100	0.94	92	100	0.86	88	100	0.95
Need for feeding assistance	88	NA	0.71	84	NA	0.63	100	NA	1.00	100	NA	1.00
Need for oral care	88	NA	0.72	88	NA	0.75	100	NA	1.00	88	NA	0.60
Need for MBS	84	NA	0.61	92	NA	0.46[a]	96	NA	0.92	96	NA	0.90
MBS urgency	80	NA	0.61	92	NA	0.46[a]	92	NA	1.00	92	NA	0.90
Need for FEES	100	NA	1.00	100	NA	1.00	96	NA	0.83	92	NA	0.84
FEES urgency	100	NA	1.00	100	NA	1.00	96	NA	0.91	92	NA	0.76
Need for referral	76[b]	NA	0.52[a]	64[b]	NA	0.24[a]	80	NA	0.59[a]	92	NA	0.84
Need/urgency of review	64	100	0.95	68	100	0.72	80	96	0.80	88	100	0.79

[a] < 0.6 kappa.

[b] < 80% criteria.

CSE, clinical swallow examination; DOSS, Dysphagia Outcome and Severity Scale; FEES, fiberoptic endoscopic evaluation of swallowing; MBS, modified barium swallow; NA, not applicable to calculate percentage clinical agreement (PCA) as the parameter represents nominal data; PEA, percentage exact agreement.

Table 5. Clinician Perceptions

	NONDYSPHAGIC	MILD	MODERATE	SEVERE	*H*	*P*
"I am happy with the level of patient–clinician rapport generated during this session"						
Strongly agree	15 (60)	13 (52)	12 (48)	10 (40)	2.835	0.4178
Agree	9 (36)	10 (40)	12 (48)	11 (44)		
Neutral	1 (4)	0 (0)	1 (4)	2 (8)		
Disagree	0 (0)	2 (8)	0 (0)	2 (8)		
Strongly disagree	0 (0)	0 (0)	0 (0)	0 (0)		
"I feel that I was able to satisfactorily and competently assess the patient to the best of my abilities using the system"						
Strongly agree	11 (44%)	13 (52%)	14 (56%)	3 (12%)	18.390	0.0004[a]
Agree	12 (48%)	11 (44%)	10 (40%)	13 (52%)		
Neutral	0 (0)	0 (0)	0 (0)	3 (12%)		
Disagree	2 (8%)	1 (4%)	1 (4%)	5 (20%)		
Strongly disagree	0 (0)	0 (0)	0 (0)	1 (4%)		

Data are number (%).

[a]Significant at $p < 0.05$.

swallow difficult, patients' inability to complete oromotor tasks and post-swallow voicing on command, the presence of comorbid movement disorders or agitation/impulsivity, which impacted on visual quality, and the presence of inconsistent clinical signs of aspiration.

Discussion

The current findings mirror those found previously in a smaller clinical cohort[16] and support the use of telerehabilitation to conduct CSEs with dysphagic patients. Most important is that they confirmed that key clinical decisions, including safety for oral or nonoral feeding and foods and fluids deemed safe for oral intake, were made with high levels of exact agreement between the online and FTF clinicians regardless of severity. Determining patient safety for oral or nonoral feeding is a primary objective of the CSE. Recent research[36,37] has demonstrated that in the FTF environment, clinicians use a range of clinical information collected during a CSE to help determine patient safety for oral/nonoral

feeding. Considering the high level of exact agreement observed between the online and FTF clinicians across all groups, the current data support prior research[15,16] that concluded that sufficient clinical information can be observed/collected via an online CSE assessment to enable accurate assessment of patient risk for oral intake.

In addition to the primary outcomes measures, levels of online and FTF agreement for the remainder of the CSE assessment items also proved to be high across all severity groups. The oromotor component of the CSE, including the assessment of cough status, provides valuable clinical information that assists clinicians to predict potential deficits in the swallow process. Cough strength has been ranked as fifth in the top 10 factors therapists use to inform their oral/nonoral recommendations.[36,37] Other oromotor parameters, when incomplete, have also been shown to be associated with increased odds for aspiration.[38] The ability to conduct valid and reliable online assessment of oromotor function has been reported previously[15–18,29–31,39] and is confirmed by the current data.

Decisions regarding food and fluid trials and other key recommendations were also made with high levels of agreement across all severity groups. Where occasional parameters failed to reach the set criterion, there was no particular pattern for these to occur in any one severity group or on any specific parameter. In earlier research into the levels of reliability between clinical decisions made in the FTF environment, it has been noted that < 50% of parameters within a CSE were rated with sufficient inter- or intrajudge reliability.[25] The fact that higher levels of inter-rater agreement were observed across the CSE parameters in the current study is most likely due to the pretraining conducted prior to testing enhancing consistency among the raters.

Although the results of the CSE did not appear to be influenced by dysphagia severity, the online clinicians did perceive differences in the nature of the assessment process for some, more complex, patients. Overall, clinicians felt that for the majority of patients in all groups, they could develop patient–clinician rapport and competently assess the patient to the best of their abilities. However, in the severe dysphagic group there was a small but significantly greater proportion of patients for whom the clinicians felt an optimal assessment was not as easily achieved because of increased patient complexity. These findings are consistent with prior research that demonstrated that certain patient factors, such as movement disorders, agitation, hearing impairment, and reduced vocal volume, can enhance the technical difficulty of conducting dysphagia assessments via telerehabilitation.[40] In the current study, additional issues of cognitive and/or language difficulties that complicated ability to follow instructions further limited the information the online clinician could independently collect. In these cases there was greater reliance on the assistant who helped relay information to the online clinician to assist his or her decision making.

Hence the current data do not support denying patients access to online assessment based on dysphagia severity alone. However, it does highlight the importance of considering the extent of other patient factors prior to assessment and also planning how the issues could be overcome/minimized in the online environment.[40] In recent policy guidelines it is noted that patient suitability for telerehabilitation assessments should be determined on a case-by-case basis.[41] Policy statements also stress the importance of training to ensure clinicians are competent to deliver online services, particularly for more complex patients.[41]

Conclusions

Data revealed acceptable levels of agreement for the primary outcome parameters (oral or nonoral intake or safe food and fluid levels) across all severity groups. Equally, levels of agreement for all other parameters of the CSE were not adversely impacted by dysphagia severity. Perceptions of the online clinicians, however, indicated that a greater proportion of patients in the severely dysphagic group had complex presentations and were more difficult to assess than in the other groups. The current data contribute to the emerging evidence base supporting the use of telerehabilitation to provide valid CSEs for dysphagic patients and highlight the importance for clinicians to undertake appropriate training and preparation prior to assessing more complex patients.

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