

The Efficiency of Non-instrumental Feeding Assessment in Detecting Deglutition Problems in Children: A Systematic Review

Hiba Ghamloush, Zahra Sadat Ghoreyshi* and Narges Bayat

Department of Speech Therapy, University of Social Welfare and Rehabilitation Sciences, Iran

***Corresponding Author:** Zahra Sadat Ghoreyshi, Assistant Professor of Speech Therapy, Department of Speech Therapy, University of Social Welfare and Rehabilitation Sciences, Iran.

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Abstract

Speech and Language Pathologists (SLPs) require reliable and evidence-based approaches to manage the safety of children and infants with suspected deglutition/dysphagia disorders. The aim of this study was to review the evidence behind the validity of non-instrumental methods for accurate diagnosis. A systematic search of literature published from 2011 to 2021 was conducted using Google Scholar, PubMed and ProQuest databases. Articles were selected according to predefined criteria. A total of five systematic reviews were selected and considered for review. The findings indicate that non-instrumental assessments are the first step in identifying possible dysphagia. However, there is a lack of standardized protocols and administration of assessments which may impact on the accuracy of diagnosis. Two of the selected articles were able to show some strong evidence relating to the efficiency and reliability of non-instrumental assessments being able to accurately detect deglutition problems in children.

Keywords: Pediatric; Bedside Clinical; Non-instrumental; Assessment; Deglutition

Abbreviations

SLPs: Speech and Language Pathologists; WHO: World Health Organization; RCSLT: The Royal college of Speech and Language Therapists; VFSS: Video Fluoroscopy Swallow Study; FEES: Fiber-optic Endoscopic Evaluation Of Swallowing; PICO: Problem/Population, Intervention, Comparison, and Outcome (PICO)

Introduction

There are a range of difficulties associated with eating and drinking problems in children. Difficulties can occur at the oral preparatory phase (food taken into mouth and broken down through chewing), oral phase (bolus is prepared and ready to move posteriorly in the oral cavity) or the pharyngeal phase (food moves into the esophagus). The term 'deglutition' refers to the process of swallowing. The diagnostic term 'oropharyngeal swallowing' refers to all three stages [1].

Swallowing disorders can significantly impact patients' health status. Difficulty at any of the swallow stages can result in choking or aspiration. A choking incident is defined as food lodged in the trachea preventing air from entering the lungs and leading to respiratory distress. Aspiration of food is when food or fluid passes down the trachea the level below the true vocal folds. Inability to safely swallow can cause chest infections, pneumonia, dehydration, malnutrition and weight loss, resulting in medical management [1].

Inability to meet nutrition and hydration requirements impacts on overall health and development [3,4]. Adequate nutrition and hydration support physical and neurological development. It also ensures all organs function adequately and assists in the production of energy which is required for day to day functioning and learning [2,3]. The World Health Organization (WHO) has provided a number of recent statistics demonstrating the impact of inade-

quate nutrition. WHO 2021 reports that 45% of child deaths every year are attributed to a lack of nourishment. They also discuss the importance of adequate nutrition from birth to support growth and development but also reduce the risk of chronic illnesses and death [4]. These reasons highlight why it is critical for children with swallowing disorders to be managed promptly and efficiently by speech and language pathology's (SLP's) who are trained in dysphagia management [1].

It is thought that those at most risk of swallowing difficulties in the pediatric population are those with a neurological disability or those born pre-term. There are a number of papers outlining these difficulties in children with developmental disorders. The Royal college of Speech and Language Therapists (RCSLT) report the following statistics on the incidence of feeding and swallowing difficulties in the pediatric population (Table 1) [5].

Population	Incidences (%)
Typically developing pediatric population	25-45%
Children with cerebral palsy	31-99%
Children with general neurodevelopmental disabilities	21-44%
Infants born prematurely	26.8-40%
Children with acquired conditions during the acute phase of care	68-72%

Table 1: Incidence of feeding and swallowing difficulties in the pediatric population based on RCSLT.

SLP's are required to take a holistic approach to assessment and management of patients with swallowing difficulties due to the impact on activity and participation in daily activities and psychosocial well-being in addition to managing health needs [4].

The efficiency of an assessment is important to get a true baseline and understanding of a patient's needs. Efficiency relates to the quality and competence of the selected assessment and its implementation and whether or not it is proficient enough to elicit all of the information needed. Efficacy relates to producing an appropriate or desired outcome. There should be efficacy in the selected assessment tool and its delivery so that the relevant outcomes are addressed and produced i.e., a baseline of all of the patient's overall health and psychosocial needs and skills relating to the swallowing disorder. The effect of the assessment means that a quantifiable

and clear result is produced which informs next steps and management of the patient's needs [6,7].

Non-instrumental assessment is known as a bedside clinical examination. In the hospital setting this is carried out at the patient's bedside. In the community setting this is carried out at a clinic. This method of assessment does not include the use of invasive or technology-based assessment. Primarily, it involves observation, discussion and physical examination of the structures and functions involved in all stages of the swallow that can be seen overtly. Use of non-instrumental clinical assessment includes case history, checklists, parent reports, questionnaires, classification inventories, oral motor/structure and sensory examinations, cranial nerve examination and food and fluid trials to assess the safety, function and competence of a patient's swallow and feeding skills. This method is considerably less expensive and less invasive for the child compared to instrumental assessments [8-11]. Formal assessments are available but many SLP's use their knowledge and experience alongside informal checklists to navigate their assessment, establish baselines and a management plan. It is also the first step to establish a cause and whether or not an instrumental assessment is required [12].

Instrumental assessment is undertaken when symptoms are not obviously visible but difficulties related to possible aspiration or penetration are present i.e., coughing before, during or after meals, inability to manage secretions, frequent nasal regurgitation and unexplained chest infections. It allows observation and assessment of the functions and structures involved in the pharyngeal stage of swallow which can be difficult or not possible to detect in a bedside swallowing examination. Instrumental assessment usually takes place in a more formal, medical setting such as hospitals. The video fluoroscopy swallow study (VFSS) is considered to be a gold standard instrumental tool for assessing all phases of the swallow observed through a moving x-ray [13]. Fiberoptic endoscopic evaluation of swallowing (FEES) is also another instrumental method often used in the diagnosis of swallowing disorders. A nasal tube with camera is passed and sits above the epiglottis and from this position, it allows the SLP to view the larynx, pharynx and trachea whilst a swallow takes place [14].

Non-instrumental assessment is an important first step in diagnosing dysphagia. A thorough bedside clinical examination can identify difficulties at the structure and function level to identify

risk and inform management. This method is preferred to ensure patient safety and comfort because both VFSS and FEES procedures are still considerably more invasive to the patient compared to non-instrumental assessments. It is important to consider the disadvantages of instrumental assessments. For example, disadvantages of VFSS include cost and exposure to radiation [13]. Additionally, the patient must be able to cooperate with the procedure and it is important to note the test is a snapshot of that moment in time and may not reflect a full picture of environmental factors contributing to difficulties [11]. FEES is a more accessible instrumental tool for assessment and can be used across ages from neo-nates to adults, does not require use of barium or radiation exposure and is reported to be more cost effective than VFSS. It does however, require the patient being able to tolerate the passing of a nasal scope which although isn't painful, can be uncomfortable [14].

This topic was chosen because the assessment process is fundamental to the practice of an SLP when diagnosing swallowing disorders and forming a management plan. There are several other systematic reviews that address the same topic however, none in the last three years. Additionally, it seems the majority of research related to this topic is limited or of poor quality. There is not enough evidence in previous systematic reviews to answer the question being posed. Variability in assessments selected means it is difficult to use standard protocols in methodology. This again limits the ability to elicit concrete evidence which can then be put into practice. SLP's require strong evidence to direct the assessment and management of patients with swallowing disorders in order to ensure safety and quality when managing a patient. The difficulties highlighted in this paragraph indicate that a lack of evidence or poor quality of evidence means there may be variability amongst the practice of SLP's and how they treat patients. A patient centered approach and differential diagnosis is key, however standard protocols for assessment ensure that all aspects of need are methodically assessed in this population. This is only possible if there is a robust body of evidence of high-quality methodology which is supported by proven outcomes. All of the systematic reviews selected in this review highlight the need for further research. The aim of this article is to review recent literature and specifically systematic reviews which have investigated the research relating to the efficiency of non-instrumental assessment in diagnosing a swallowing disorder.

Materials and Methods

A literature search was conducted using the following electronic databases; Google Scholar, PubMed, and ProQuest from 2011 to June 2021.

A preliminary search was undertaken using a range of search terms and synonyms to identify which terms produced the most relevant literature for the review. Final search terms were then identified to determine the most appropriate literature using the Problem/Population, Intervention, Comparison, and Outcome (PICO) method. The PICO method is thought to be a useful research tool and was implemented to ascertain appropriate literature. The PICO method ensures terms are created that are relevant to the population, interventions, controls and outcomes specific to the review, thereby aiming to identify the widest range of significant literature (see table 2) [15]. Additionally, systematic review articles only were selected as during searches they were found to have the most pertinent information related to the study question.

PICO	Search Terms
Population	"pediatric" and/or "children"
Intervention/Control	"bedside clinical" and/or "non-instrumental"
Outcome	"swallowing and/or deglutition" and/or "dysphagia assessment" and/or "feeding problems"

Table 2: Search terms and Boolean operators.

In addition to the PICO method to isolate literature specific to the review, the final set of articles included in this review were also subject to a set of inclusion and exclusion criteria. The inclusion criteria required selection of articles published worldwide but in the English language/ international language and was specific to the pediatric population with an age range of birth to sixteen years. The types of articles had to be systematic reviews with high citations. A time interval was used so that only articles published between 2011 and 2021 were selected. This was to obtain the most recent articles as well as ensuring there was a good range and yield of articles available.

The exclusion criteria included articles which referred to intervention only and did not refer to the assessment process. The adult population and instrumental assessment only were also excluded

due to the title of this review. Finally, extensions or reviews of previous systematic reviews were also excluded because this would mostly highlight procedural and methodological flaws in previous systematic reviews and not focus on non-instrumental assessment process alone. The search process is demonstrated in table 3.

	Google Scholar	PubMed	ProQuest
Search terms and Boolean operators	33	75	12
Read titles	33	75	12
Read abstracts	17	8	3
Read articles	2	3	1
Articles	Heckathorn., <i>et al.</i> (2015); Romano., <i>et al.</i> (2014)	Barton., <i>et al.</i> (2017); Calvo., <i>et al.</i> (2016); Benfer., <i>et al.</i> (2012)	Heckathorn., <i>et al.</i> (2015)

Table 3: Search process.

All articles selected for review were analyzed using the Checklist for Systematic Reviews and Research Syntheses from The Joanna Briggs Institute Critical Appraisal tools for use in The Joanna Briggs Institute Systematic Reviews. It consists of 11 questions requiring 'yes, no, unclear or not applicable' boxes to appraise the review [16]. Table 4 presents the Checklist for Systematic Reviews and Research to define and compare the key characteristics of each systematic review and evaluate the reliability and validity of each article.

	Heckathorn., <i>et al.</i> (2015)	Romano., <i>et al.</i> (2014)	Barton., <i>et al.</i> (2017)	Calvo., <i>et al.</i> (2016)	Benfer., <i>et al.</i> (2012)
Is the review question clearly and explicitly stated?	Yes	Yes	Yes	Yes	Yes
Were the inclusion criteria appropriate for the review question?	Yes	Yes	Yes	Yes	Yes
Was the search strategy appropriate?	Yes	Yes	Yes	Yes	Yes

Were the sources and resources used to search for studies adequate?	Yes	Yes	Yes	Yes	Yes
Were the criteria for appraising studies appropriate?	No checklist/ tool but use of inclusion/ exclusion criteria specific to the assessments.	Yes	Unclear	Yes	Yes
Was critical appraisal conducted by two or more reviewers independently?	Unclear	Yes	Yes	Yes	Unclear
Were there methods to minimize errors in data extraction?	Yes	Yes	Yes	Yes	Yes
Were the methods used to combine studies appropriate?	Yes	Yes	Yes	Yes	Yes
Was the likelihood of publication bias assessed?	No	No	No	No	No
Were recommendations for policy and/or practice supported by the reported data?	Yes	Yes	Yes	Yes	Yes
Were the specific directives for new research appropriate?	Yes	Yes	Yes	Yes	Yes

Table 4: Checklist for Systematic Reviews and Research.

Results and Discussion

Search of the mentioned databases generated a total of 122 articles of which all titles were read. This gave indication of which abstracts were relevant to the study question and a total of 28 abstracts were then read. A total of 5 articles were then selected in accordance with the inclusion and exclusion criteria stated. The selected systematic reviews were:

- Systematic Review: Non-Instrumental Swallowing and Feeding Assessments in Pediatrics (Heckathorn., *et al.* 2015) [17]
- The diagnostic test accuracy of clinical swallow assessment for oropharyngeal aspiration: a systematic review (Romano., *et al.* 2014) [18]
- Pediatric Oral Motor Feeding Assessments: A Systematic Review (Barton., *et al.* 2017) [19]
- Clinimetrics of measures of oropharyngeal dysphagia for preschool children with cerebral palsy and neurodevelopmental disabilities: a systematic review (Benfer., *et al.* 2012) [11]
- Diagnostic accuracy of the clinical feeding evaluation in detecting aspiration in children: a systematic review (Calvo., *et al.* 2016) [20].

Time constraints did not allow for search of the reference lists of selected articles but would be considered as a strategy in future searches. All of the systematic reviews selected for this review were able to provide some answers and direction to address the aim of this review.

A summary of the quality of the articles selected is presented below as per the Checklist for Systematic Reviews and Research Syntheses.

Is the review question clearly and explicitly stated?

All articles clearly stated the aim of the review they were conducting.

Were the inclusion criteria appropriate for the review question?

All authors used an appropriate set of inclusion and exclusion criteria to ensure they were able to select articles which were most pertinent to their review question.

Was the search strategy appropriate?

All authors used appropriate database engines and strategies to search for articles and provided evidence of this. Three completed searches with a time line of inception to the date the search was being completed except for Barton., *et al.* who searched for articles only in the previous year. Additionally, Benfer., *et al.* chose to change the date ranges for each database they were using, it is not clear why this was done.

Were the sources and resources used to search for studies adequate?

All reviews used multistep approaches in their searches. Three of the studies used a minimum of 5 databases for searches to identify as many relevant articles as possible. The other two made use of only 2 databases thus limiting results. All used databases that were relevant to the topic and would produce the most appropriate results.

Were the criteria for appraising studies appropriate?

Three of the reviews used a well-known formal tool to appraise quality of their articles. One used multiple tools to strengthen the appraisal process. Barton., *et al.* used a reliability and validity measure as their tool which produced specific quantitative results which seemed appropriate for the aim and methodology behind their review.

Was critical appraisal conducted by two or more reviewers independently?

Whilst all authors used 2 independent reviewers for the literature search and data extraction, two of the studies did not explicitly say if this was also the case for quality appraisal.

Were there methods to minimize errors in data extraction?

All studies conducted data extraction in duplicate. Romano., *et al.* and Calvo., *et al.* also used specific data extraction tools.

Were the methods used to combine studies appropriate?

All authors provided some explanation for diversity and heterogeneity within studies. Romano., *et al.* however, did give explanation for use of meta-analysis in their review and provided statisti-

cal evidence to explain possible sources of heterogeneity between studies. All presented tables to demonstrate results in order to support synthesis of the collected information. Barton., *et al.* documented variability in the components of selected assessments.

All of the studies were able to provide recommendations for practice which was supported by their results. Romano., *et al.* were able to provide the most specific recommendations with regards to practice.

Was the likelihood of publication bias assessed?

Were the specific directives for new research appropriate?

None of the reviews mentioned the likelihood of publication bias.

All except Calvo., *et al.* provided appropriate suggestions to extend the current research.

Were recommendations for policy and/or practice supported by the reported data?

An overview of each systematic is presented to summarize and compare the overall content in each article in table 5.

Authors	Objective	Type of Assessment	Number of articles/assessments reviewed	Population characteristics
Heckathorn., <i>et al.</i> (2015)	To find non-instrumental assessments for pediatric swallowing and feeding function.	Published and unpublished. All assessments had either caregiver or clinician respondents.	30 assessments.	High variability.
Romano., <i>et al.</i> (2014)	To synthesize the best available evidence on the diagnostic test accuracy (sensitivity and specificity) of Clinical Swallow Assessment compared with Video Fluoroscopic Swallow Study in diagnosing oropharyngeal aspiration in children and adults with dysphagia	Pre-defined checklists for clinical bedside assessment. VFSS.	13 articles.	Any patients referred for swallowing assessment, specifically assessed for oropharyngeal aspiration – no exclusion based on age or gender. Study results excluded for the population of head and neck cancer patients, patients with a tracheostomy in situ and patients with craniofacial anomalies
Barton., <i>et al.</i> (2017)	To describe the clinical properties and psychometric soundness of pediatric oral motor feeding assessments.	Range of structured clinical tools.	12 assessment tools.	Pediatric population.
Calvo., <i>et al.</i> (2016)	To determine the diagnostic accuracy of clinical feeding evaluation (CFE) compared to instrumental assessments in detecting oropharyngeal aspiration in children.	All published and unpublished assessments comparing CFE to VFSS assessment.	6 studies.	High variability.

Benfer., <i>et al.</i> (2012)	To determine the psychometric properties and clinical utility of objective measures of oropharyngeal dysphagia (OPD) in children with cerebral palsy or neuro developmental disabilities.	Standardized assessments.	9 assessment tools.	Children with cerebral palsy or neuro developmental disabilities aged 12 months to 5 years.
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Table 5: Overview of the articles.

Each of the articles selected presented thorough, robust search strategies and data collection although Calvo., *et al.* realized their inclusion criteria impacted on the overall quality of articles selected.

Heckathorn., *et al.* (2015)

These authors selected 30 assessments to review. They found that of these, 24 assessments had no guidance for scoring or interpretation of scores making them subjective to the administrator. It also highlights the lack of standardized procedures and assessments available [17].

Romano., *et al.* (2014)

This group selected 13 studies for their review. They were able to find good quality articles with reliable and valid results due to their own robust search methods and data extraction strategy. Although their results found that clinical assessment method is accurate versus instrumental assessment, they were only able to provide evidence for the adult population and not pediatric [18].

Barton., *et al.* (2017)

A total of 12 assessments were selected in this review. The authors reported variability in the assessments chosen which reduces the weight of evidence to support efficiency for non-instrumental assessment as one whole method. They found that although clinical components of assessments were fair, psychometric reliability was not demonstrated impacting on the accuracy, validity and reliability of the assessments [19].

Benfer., *et al.* (2012)

This review was carried out for a specific pediatric population (CP and neurodevelopmental disabilities). They selected 9 assess-

ment tools in total to review. Out of these, 2 were found to be the most efficient due to their psychometric properties which were also published providing good evidence of their reliability and validity. They also reported 2 tools with strong clinical components. They provide some evidence to help clinicians select appropriate and reliable tools for this population [11].

Calvo., *et al.* (2016)

The authors selected 6 studies which addressed their aim, they further sought to reinforce evidence by looking at non-instrumental methods as well as instrumental methods for comparison. Unfortunately, they found that the quality of methods used in the selected studies was low because of bias and concern over clinical applicability. They also found that clinical assessment varies in practice which means standard protocols are not often used. This group were unable to answer their research question due to the quality of data collected for review [20].

Non-instrumental assessments are a necessary first step in diagnosis to identify baselines, the presence of dysphagia and then to inform management. They also provide valuable information to determine if an instrumental assessment is also necessary. There are limitations however. Additionally, non-instrumental/bedside clinical examinations are not always adequate for diagnosis of difficulties at the pharyngeal phase of swallow. For example, in the case of a patient with suspected silent aspiration, here an instrumental assessment is non-negotiable to make an accurate diagnosis [17].

Conclusion

Clinicians are most effective when using an evidence-based approach alongside clinical experience to manage the needs of patients. Systematic reviews assist by looking at the quality of evidence that exists and their validity and subsequently implications

for practice [21]. Out of the 5 articles selected, only 2 provided some evidence to support the efficiency of non-instrumental assessments for detecting deglutition disorders. It is important to note although they provide some evidence, the evidence is also limited and recommendations have been for further research in this area by all authors. This review is in agreement with the recommendations from articles selected, standardized protocols and assessments are needed and further research is needed to look at the psychometric properties of currently available tools. Reliability and validity of available tools through methods such as re-testing, inter rating is crucial in order to ensure the most accurate administration and diagnosis for the patient.

This review had some limitations. Time constraints and the limited number of reviewers impacted on the number of articles selected. A broader range and type of search databases would be considered in future. Additionally, it may be worth re wording the study question and subsequent search terms to make them more specific. A future study could expand on the work of recent reviews addressing the current study aim. It could also utilize the standardized tools which the articles in this review have found to have merit and compare them to the efficiency of instrumental assessments.

Conflict of Interest

The authors declare that there is no conflict of interest.

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