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# CLINICAL SWALLOWING EVALUATION SCALE IN CHILDREN WITH CEREBRAL PALSY

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**ABSTRACT**

To develop and validate a clinical rating scale of swallowing in children with cerebral palsy. The proposed scale was developed based on the evaluation protocol used by a group specialized in the care of children with cerebral palsy. Ten expert judges analyzed the scale for relevance. The clinical swallow evaluation was initially performed by a specialized speech-language pathologist in seventy children with cerebral palsy. Swallowing was classified as normal, functional, mild, moderate or severe dysphagia. The proposed scale was applied by two other speech-language pathology experts. After two weeks, the entire evaluation process was carried out again. The scale presented with efficient internal consistency and reproducibility values. Cutoff value scores were established for the swallowing classifications. Sensitivity showed good results for the classification of normal/functional swallowing, which demonstrated a tendency towards good results for rating moderate and severe dysphagia, and poor results for mild dysphagia. The proposed scale presented high internal consistency and reproducibility values, with a satisfactory degree of reproducibility. It proved to be an effective tool in differentiating cerebral palsy children with or without dysphagia. It was effectively able to establish the classification of moderate and severe dysphagia, but less effectively able to differentiate mild dysphagia.



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## INTRODUCTION

Cerebral Palsy (CP) encompasses a group of permanent disorders of the development of movement and posture (Rosenbaum *et al.,* 2007). Among the alterations found in patients with CP, swallowing function disorders are observed, which are responsible for breathing and nutrition impairments (Kirby and Noel, 2007; Calis *et al.,* 2008; Sullivan, 2008). Its prevalence is not well defined, varying between 27% (Waterman *et al.,* 1992) and 99% (Calis *et al.,* 2008), depending on the evaluation instrument used. The swallowing evaluation is one of the speech-language pathologist (SLP) procedures. However, differences are observed among the diagnosis of pediatric dysphagia; some protocols only present items related to the oral phase (Reilly *et al.,* 1995; Ortega *et al.,* 2009; Sonies *et al.,* 2009), others have been developed for a variety of pathologies (Sheppard *et al.,* 2014) or do not present a reproducibility verification process (Selley *et al.,* 2011; Flabiano-Almeida *et al.,* 2014). This study proposed a dysphagia scale for children with CP, that will provide the most relevant features of the clinical evaluation of these children, and classify them according to the severity degree of dysphagia. The objective of this study was to develop and validate a clinical evaluation scale for swallowing in children with CP.

## METHODS

This study was approved by the Research Ethics Committee of the University where it was developed. Those responsible for the participants signed the Informed Consent Term before their

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participation. The proposed scale was based on a clinical swallowing evaluation protocol, used by specialized SLP of Dysphagia Group of Association of Assistance to the Disable Children (Associação de Assistência à Criança Deficiente - AACD) of São Paulo, a reference rehabilitation center, due to the absence of a standard reference of swallowing evaluation and classification in CP (Benfer *et al.,* 2013). The protocol consisted of information related to the caregiver's complaint, feeding conditions (food consistency, position and eating utensils), clinical problems, mobility and tonicity of the stomatognathic system. In addition, the protocol contained the following items that evaluated swallowing function: stripping from utensil, lip closure, extraoral food escape, tongue mobility, bolus preparation and organization, oral ejection, chewing, sucking, oral transit time, laryngeal elevation, signs from cervical auscultation and clinical signs suggestive of supraglottic penetration or tracheal laryngoaspiration. The development process phase began considering, among these swallowing function items, the most relevant to the classification of swallowing in children with CP were selected, considering the impact on nutrition, hydration and pulmonary function. Thus, the authors selected the ones that, according to their clinical experience, would promote worse nutritional and/or pulmonary impairment:

- Stripping from the utensil: it comprises the drawing of food and liquid from the utensil with the use of lips. This item was included because it may increase the risk of both lung and nutritional problems. Oral intake alteration could promote the early escape to the pharynx, with subsequent tracheal aspiration, and could also promote oral manipulation difficulty, thus increasing energy expenditure;
- Extraoral food escape: comprises the escape of food and liquid from the oral cavity after it has been inserted, regardless of the form of intake. This item was included because of the impact its alteration may have on nutrition. This impact may occur either by the extraoral loss of food inserted from the oral cavity, or by energy expense increase during the meal;
- Oral transit time: comprises the time (in seconds) elapsed from the moment the food is inserted into the oral cavity until the first swallowing. Alteration in oral transit time may have a nutritional impact because the increase in the oral conduction time of the bolus reflect an increase of the energy expenditure during the meal;
- Oral cavity residue: comprises food residue in the oral cavity after three consecutive and spontaneous swallows. This item was selected because its alteration has an impact on the nutritional aspect, as it promotes an increase in the number of swallows necessary for oral conduction of the total volume of food offered, with consequent increase in energy expenditure during the meal.
- Cervical auscultation: comprises the perceptual analysis of the swallowing sounds picked up by means of a stethoscope positioned in the lateral region of the thyroid cartilage of the larynx during swallowing. This item was selected because of its correlation to pulmonary risks, as it may aid the detection of the signs suggestive of laryngeal penetration and/or tracheal aspiration;
- Clinical signs suggestive of laryngeal penetration and/or tracheal aspiration: includes coughing, choking, nostril flaring, facial color change, “wet” vocal quality, changes in respiratory pattern or noise during oral intake (Warms *et al.,* 2000; DeMatteo *et al.,* 2005; Weir *et al.,* 2009). As in cervical auscultation, the choice of this item was related to the risk of tracheal aspiration. Silent aspiration is often found in children with cerebral palsy.

All items selected could clinically impact, in a greater or lesser extent. So, as the scale also intended to guide the SLP in the classification of dysphagia, it was necessary to differentiate the impact for each item. Then, at the end of each six items, the authors, by clinical experience, assigned the following rating according to the clinical relevance that each item produced on respiration and nutrition conditions:

- ***Rating one* (1):** for items of less clinical impact – oral cavity residue;
- ***Rating two* (2):** for items of intermediate clinical impact – stripping from the utensil, oral transit time and cervical auscultation;
- ***Rating three* (3):** for items of most clinical impact – extraoral escape and clinical signs suggestive of supraglottic penetration or tracheal laryngoaspiration.

After selecting the items with their respective ratings, for each one were created three subitems representing three scoring options according to the occurrence and severity of the evaluated items. The description of the subitems was also performed according to the authors’ clinical experience. Only data related to oral transit time were based on information from the literature (Weckmueller *et al.,* 2011; Lustre *et al.,* 2013). The subitem that represented normality/functionality received a score of zero (0). The subitem that represented the most severe condition received a score of two (2). Finally, the intermediate subitem between normality/functionality and severe received a score of one (1). Each of the six items presented its subitems selected according to the swallowing physiology. The score obtained with the subitem classification was multiplied by the rating for the respective item, generating a partial score for each of the six itens. Thus, the final score established by the scale represented the sum of the partial scores of the six items, ranging from 0 to 26 points. The lower the number of the final score, the better the functional performance of swallowing. As different food textures may have different swallowing patterns, the scale should be completed independently for each consistency assessed, with final scores produced for each consistency. Solid food texture was not evaluated by this scale, since in this moment aspects related to mastication were not considered. Children with cerebral palsy and dysphagia commonly do not eat solid food, due to changes in oral motor patterns. The food could have been offered in any kind of spoon and/or cup, according to the patient's habit. The utensils are an important influence for the oral motor pattern, but in the proposed scale, the children were evaluated with utensils they were accustomed to use. The content validation phase began, to show that the scale met the needs of the clinical professionals, that the description of the items presented adequate terms and easy interpretation. The scale was sent to ten specialized SLPs, with least ten years of experience working with children with CP and dysphagia (SLP judges). These professionals were not informed about the other judges and it was requested that the evaluation were performed individually. The SLPs judged which items was relevant to the scale and their definitions and value of each item. For each of the six items there was the option of checking "Yes", agreeing on the permanence of that item and how it was described, or

"No", disagreeing with any of these aspects. The scale obtained 90% of agreement, that is,"Yes" answers. The 10% disagreement referred to a single "No" response in "Oral cavity residue" item, with a suggestion of a minor modification. Therefore, all suggestions made by the SLP judges comprised small changes in terminology and did not result in the removal or insertion of any items. After creating the scale, its reproducibility was tested with children with CP, in a cross-sectional observational study. We chose the CP classification criteria according to motor impairment. The Gross Motor Function Classification System (GMFCS) (Palisano *et al.,* 2008) was selected and classifies children into five levels according to the functional impact of CP on motor changes. The higher the level classification, the greater the motor severity. The scale was applied to 70 children with CP (ten motor level I children, ten motor level II children, ten motor III children, 19 motor level IV children and 21 motor level V children of the GMFCS). The children were attended in the Association of Assistance to the Disable Children (Associação de Assistência à Criança Deficiente - AACD) of São Paulo, where the research was developed**.** The children were 36 males and 34 females, aged between 2 and 16 years (mean age 4 years and 8 months). The inclusion criteria were to present a diagnosis of CP and classifications according to GMFCS. Exclusion criteria were: to present syndromes or neuromuscular disorders associated with CP; to make exclusive use of alternative feeding; to offer restrictions on the ingestion of some consistencies (liquid or pasty) offered in this study. Then, the children were submitted to a clinical swallowing evaluation by a SLP specialized in dysphagia in children with CP (Evaluator A). This moment of evaluation was called First Moment. The evaluation consisted of observing the offer by the child or his/her caregiver, with food textures in the liquid (water) and pasty consistency (petit-suisse type yogurt), in the child's typical posture with the food utensil typically used. The child was presented with two boluses of each consistency, starting with the liquid. The swallowing time was measured using 8905-34 Herweg digital timer. Cervical auscultation was performed using Littmann pediatric stethoscope positioned in the lateral region of the thyroid cartilage of the larynx before, during and after swallowing. Evaluator A rated the observed swallowing function according to the clinical assessment usually performed by Dysphagia Group, classifying the swallowing in:

- Normal swallowing: efficient capture of the bolus when stripping from the utensil; absence of extraoral escape; efficient preparation of the bolus within the expected time; absence of oral cavity residue after swallowing or a small volume of residue spontaneously removed during the next swallow; clear cervical auscultation; absence of clinical signs suggestive of laryngeal penetration and/or tracheal aspiration.

- Functional swallowing: efficient or partially efficient stripping of the bolus from the utensil; absence of extraoral escape; preparation of the bolus in expected or slightly increased time; absence of oral cavity residue after swallowing or a small volume of residue spontaneously removed during the next swallow; clear cervical auscultation; absence of clinical signs suggestive of laryngeal penetration and/or tracheal aspiration.
- Mild dysphagia: partially efficient or inefficient ability to strip the bolus from the utensil; extraoral escape of up to half of the presented bolus; preparation of the bolus in adequate or slightly increased expected time; oral cavity residue after swallowing, up to half of the bolus volume; clear cervical auscultation; absence of clinical signs suggestive of laryngeal penetration and/or tracheal aspiration.
- Moderate dysphagia: partially efficient or inefficient ability to strip the bolus from the utensil; extraoral escape at or above half of the presented bolus; preparation of the bolus in slightly increased expected time; oral cavity residue after swallowing, up to half the bolus volume; clear or noisy cervical auscultation with clearing of this noise after the next swallowing, coughing or throat clearing; clinical signs suggestive of laryngeal penetration and/or tracheal aspiration. After coughing, throat clearing or a second swallow, the clinical signs does not remains (apparent protection of the airways);
- Severe dysphagia: inefficient stripping of the bolus from the utensil; oral cavity residue after swallowing, over half the bolus volume; preparation of the bolus in slightly increased or increased expected time; oral cavity residue after swallowing, over half the bolus volume; noisy cervical auscultation, with or without clearing of this noise after the next swallowing, coughing or throat clearing; and clinical signs suggestive of laryngeal penetration and/or tracheal aspiration, without apparent protection of the airways. That is, effective coughing, throat clearing or a second swallow may not happen.

While Evaluator A performed the swallowing evaluation, two other SLPs (Evaluators B and C), also CP dysphagia specialists, applied the proposed scale. The two evaluators applied the scale independently from each other and consider the worst observed performance, when a functionality difference was noted between the same bolus consistency provided. A new swallowing evaluation was performed after 15 days. The same consistencies, posture, utensils and food supply were maintained as in the First Moment. The same Evaluators also performed the second evaluation (Second Moment). The data obtained with the application of the scale were compared to each other. In addition, the scale's scores were correlated with the rating of swallowing established by Evaluator A to obtaining cutoff scores.

**Statistical analysis**

The intraclass correlation coefficient (ICC) test was used to verify the internal consistency of the scale by checking if there was significant inter-relationship between B and C, as well as with the analysis of the results of intra-rater reproducibility. The results of the application of the scale were similar between Evaluators B and C, and between the both moments of evaluation. Therefore, Evaluator B and the First Moment were randomly drawn for the following analyzes. A ROC Curve (receiver operating characteristic curve) analysis was performed in order to obtain the cutoff values assigned by Evaluator B, according to the categories established by Evaluator A. The Kruskall-Wallis test was applied for the comparative analysis between the means of the scale's scores applied by Evaluator B and the swallowing classifications of Evaluator A. The level of significance was set at $\geq 0.05$ or 5%. The statistically significant results were marked with an asterisk (*).

**Table 1. Clinical swallowing evaluation scale in cerebral palsy**

**Clinical Swallowing Evaluation Scale in Cerebral Palsy**
Date**:** _____
Name: _____
Date of birth: _____ Age _____
Diagnostic: _____

Food Consistencies:
( ) Liquid ( ) Pasty

**ITEMS:**

**1) Stripping from the Utensil**
It comprises stripping food from the utensil through the use of lips or teeth. The following will be considered:
( ) Efficient - stripping is carried out voluntarily by the lips or teeth, being able to remove the food from the presented utensil (glass or spoon) without any loss. Score 0
( ) Partially efficient – the stripping is carried out voluntarily by the lips or teeth, but the patient partially withdraws the food from the presented utensil. Score 1
( ) Inefficient - there is no voluntary stripping, food is inserted into the oral cavity by the caregiver.
Score 2
Partial Score (rating 2) _____

**2) Extraoral escape**
It comprises the bolus escape from the oral cavity after it has been inserted, regardless of the intake form. The following will be considered:
( ) Absent / mild – there is no bolus escape from the oral cavity or there is oral residue up to the level of the lower lip. Score 0
( ) Moderate – there is up to 50% of the bolus presented. Score 1
( ) Severe – there is more than 50% of the bolus presented. Score 2.
Partial Score (rating 3) _____

**3) Oral transit time**
It comprises the time elapsed from the moment the bolus is inserted into the oral cavity, until its first swallowing. The following will be considered:
( ) Adequade – up to 3 seconds for pasty consistency and up to 2 seconds for liquid consistency. Score 0
( ) Slightly increased – 3 to 5 seconds for pasty consistency and 2 to 3 seconds for liquid consistency. Score 1
( ) Increased – above 5 seconds for pasty consistency and above 3 seconds for liquid consistency. Score 2
Partial Score (rating 2) _____

**4) Oral Cavity Residue**
It comprises food residue in an oral cavity region, after 3 spontaneous swallows, of the same ingested bolus. The following will be considered:
( ) Absent - no oral cavity residue. Score 0
( ) Mildly present - there is up to 50% of oral cavity residue of the bolus presented. Score 1
( ) Present – there is more than 50% of oral cavity residue of the bolus presented. Score 2
Partial Score (rating 1) _____

**5) Cervical Auscultation**
Comprises swallowing sounds captured by use of a stethoscope positioned in the lateral region of the thyroid cartilage during swallowing.
( ) Clear / unaltered - no audible noises suggestive of food stasis and/or laryngeal penetration and/or tracheal aspiration. Score 0
( ) Noisy with clearing – noises are suggestive of food stasis and/or laryngeal penetration and/or tracheal aspiration, but these no longer occur after multiple swallowing or throat clearing/coughing. Score 1
( ) Noisy without clearing – noises suggestive of food stasis and/or laryngeal penetration and/or tracheal aspiration are audible, and these remain even after multiple swallowing or throat clearing/coughing. Score 2
Partial Score (rating 2) _____

**6) Clinical signs suggestive of supraglottic penetration or tracheal laryngoaspiration**
It comprises the presence of clinical signs suggestive of supraglottic penetration or tracheal laryngoaspiration during bolus supply. Clinical signs to consider are the presence of coughing, choking, nasal flaring, change in facial color, presence of a "wet" voice, respiratory pattern change and/or noisy breathing. The following will be considered:

( ) Absent - no clinical signs. Score 0
( ) Present with apparent protection – clinical signs occur, but the patient appears to be able to protect himself/herself with a secondary swallow and /or spontaneous cough or throat clear, which eliminate the clinical signs suggestive of previously observed. Score 1
( ) Present - clinical signs occur without the patient presenting effective protection. The patient does not show any protective reaction such as secondary swallowing, throat clearing or coughing, or shows these reactions without eliminating the clinical signs suggestive of supraglottic penetration or tracheal laryngoaspiration. Score 2
Partial Score (rating 3) _____
**FINAL SCORE**_____

## RESULTS

The final version of the clinical swallowing scale are shown in Table 1. The results of inter-rater reproducibility between B and C, intra-rater B and intra-rater C in the two evaluation moments, and the two food consistencies shows high inter-rater reproducibility, with ICC of 0.956 to 0.973 (Table 2). A similar result showing good reproducibility was found in the intra-rater B and intra-rater C analyzes, in the two moments (ICC of 0.897 to 0.942). The cutoff scores for the swallowing classifications established by Evaluator A, according to the scores assigned by Evaluator B, were found statistically significant ($p < 0.001^{*}$) for all swallowing classifications in both consistencies (Table 3). The same cutoff values were observed for the normal and functional classifications and a progressive increase of the cutoff scores with the worst severity of dysphagia. Regarding to the sensitivity, values of the cutoff scores obtained for each swallowing classifications were good for the classification of normal/functional swallowing (0.9394 for liquid and 0.9091 for pasty), a tendency to good results (above 0.7) for moderate dysphagia (0.7692 for liquid and 0.7778 for pasty) and severe dysphagia

**Table 2. Inter-rater analysis of B and C, intra-rater B and intra-rater C for liquid and pasty consistencies, during the two evaluation moments**

| Analysis | Consistency | Comparative | ICC[a] | 95% Confidence Interval | |
|---|---|---|---|---|---|
| | | | | Inferior | Superior |
| Inter-rater | Liquid | B[b] x C[c] – First[d] | 0,968 | 0,948 | 0,980 |
| | | B x C – Second[e] | 0,973 | 0,957 | 0,983 |
| | Pasty | B x C – First | 0,973 | 0,957 | 0,983 |
| | | B x C – Second | 0,956 | 0,929 | 0,972 |
| Intra-rater | Liquid | B – First X Second | 0,897 | 0,834 | 0,936 |
| | | C – First X Second | 0,942 | 0,907 | 0,964 |
| | Pasty | B – First X Second | 0,907 | 0,850 | 0,942 |
| | | C – First X Second | 0,919 | 0,870 | 0,950 |

[a] Intraclass Correlation Coefficient; [b]evaluator B; [c]evaluator C; [d]First Moment; [e] Second Moment.

**Table 3. Assignment descriptions of the cutoff values of the scores of Evaluator B according to the swallowing classifications established by Evaluator A, for the liquid and pasty consistencies**

| Consistency | Variable Evaluator A | ROC Curve Area | Cutoff Value | p[a] |
|---|---|---|---|---|
| Liquid | normal | 0,939 | 1 | <0,001* |
| | functional | 0,883 | 1 | <0,001* |
| | mild | 0,966 | 6 | <0,001* |
| | moderate | 0,954 | 13 | <0,001* |
| Pasty | normal | 0,943 | 3 | <0,001* |
| | functional | 0,941 | 3 | <0,001* |
| | mild | 0,973 | 6 | <0,001* |
| | moderate | 0,989 | 16 | <0,001* |

[a] significance

**Table 4. Comparison between the swallowing classifications established by Evaluator A and the score means of Evaluator B, for the liquid and pasty consistency**

| | | Evaluator A – First Moment | | | | | | p[c] |
|---|---|---|---|---|---|---|---|---|
| | | normal | functional | mild | moderate | severe | Total | |
| Evaluator B | n[a] | 29 | 4 | 10 | 13 | 14 | 70 | <0,001* |
| Liquid | average | 0,00 | 3,75 | 3,60 | 10,31 | 16,07 | 5,86 | |
| | medium | 0,00 | 3,00 | 3,00 | 12,00 | 18,00 | 2,00 | |
| | SD[b] | 0,000 | 4,500 | 2,914 | 3,860 | 5,196 | 7,070 | |
| Evaluator B | n | 28 | 5 | 15 | 18 | 4 | 70 | <0,001* |
| Pasty | average | 0,54 | 3,00 | 4,67 | 11,22 | 19,25 | 5,41 | |
| | medium | 0,00 | 2,00 | 4,00 | 10,50 | 20,00 | 3,50 | |
| | SD | 1,036 | 2,449 | 3,288 | 4,066 | 2,363 | 6,114 | |

[a] number of subjects; [b]standard deviation; [c] significance.

(0.7143 for liquid and 0.7500 for pasty). However, the result was unsatisfactory in the sensitivity to detect mild dysphagia for both consistencies (0.600 for liquid and 0.4667 for pasty). The specificity values for all swallowing classification were: normal/functional swallowing (0.9189 for liquid and 0.8649 for pasty), mild dysphagia (0.9500 for liquid and 0.9091 for pasty), moderate dysphagia (0.8947 for liquid and 0.9231 for pasty) and severe dysphagia (0.9821 for liquid and 0.9697 for pasty). Since not all sensitivity values of cutoff points were good, we compared the mean scores for each dysphagia classification, without establishing a cutoff score (Table 4). It was possible to verify that, for both consistencies, there was a significance statistical difference ($p < 0.001^*$) among the scores found for dysphagia classifications. Again, we observed similar scores for the classification of normal and functional swallowing, and a progressive increase of the score as the dysphagia severity worsened.

## DISCUSSION

The clinical swallowing evaluation is the most frequently used assessment tool to test swallowing function. Pediatric dysphagia has few tools designed specifically for this population (Reilly *et al.,* 1995; Ortega *et al.,* 2009; Sonies *et al.,* 2009; Sheppard *et al.,* 2014; Selley *et al.,* 2001; Flabiano-Almeida *et al.,* 2014; Santos *et al.,* 2005; Wilson *et al.,* 2009; Sellers *et al.,* 2014) and none of them is still considered gold standard in the clinical evaluation process. The absence of an efficient and specific instrument for swallowing evaluation in children with CP, makes difficult to compare and verify the results. A lack of standardization also exists in regards to terminology in pediatric dysphagia, for example, the classification of swallowing. This study relies on a non-validated classification, thus used by a specialized dysphagia group in this population. The validation of the protocol's contents, in the absence of a gold standard of reference, has been performed by the analysis of experts in the subject (Sonies *et al.,* 2002; Custers, 2002). The reproducibility of inter-evaluators B and C showed that the proposed scale presented internal consistency, which means that it was efficient in producing similar results when applied by different evaluators. The results showed high reproducibility in checking the similarity of the results in the test and retest application. Some of the swallowing evaluation protocols in children with CP also perform the reproducibility. The Schedule for Oral Motor Assessment – SOMA (Reilly *et al.,* 1995) presented high internal consistency and reproducibility in its validation. Despite this, the SOMA encompasses only aspects of the preparatory and oral stages of swallowing. The same occurs for the Oral Motor Assessment Scale – OMAS (Ortega *et al.,* 2009) the Brief Assessment of Motor Function (Oral Motor Deglutition Scale) (Sonies *et al.,* 2008). Some of the scale items required great experience from the evaluator or had great analysis difficulty. The cervical auscultation and the

presence of clinical signs suggestive of supraglottic penetration or tracheal laryngoaspiration are difficult to assess, since they are not visualized but perceived/interpreted by the evaluator. Silent aspiration, i.e., the entrance of food and/or liquids into the lower airways without protective cough reflex, further complicates the correct signaling of the clinical signs suggestive of supraglottic penetration or laryngotracheal aspiration. The presence of silent aspiration is frequent in this population, with literature data indicating absence of the protective cough reflex from 82% (DeMatteo *et al.,* 2005) to 94% (Arvedson *et al.,* 1994) of tracheal aspirations. Weir *et al.,* 2009 (Weir *et al.,* 2009), in a retrospective study that correlated the significance of clinical markers such as signs of tracheal aspiration and laryngeal penetration in children, concluded that wet voice and breathing noise were the best clinical markers in the identification of tracheal aspiration of liquids. The authors did not find any efficient clinical marker for pasty consistency aspiration. An assessment tool must have their results compared to the classification commonly used for the function to which it proposes to assess, in addition to verifying its reproducibility. The results of this comparison provided cutoff values with statistical significance for each swallowing classification, and the score obtained represented the most efficient cutoff value in differentiating the categories.

The cutoff values assigned to the normal and functional swallowing classifications were similar for both consistencies. This similarity was likely due to the fact that, in terms of safety and efficiency, the swallowing function of these two classifications were not different. The cutoff values established for the classification of normal/functional swallowing were the only ones that presented good sensitivity scores for both consistencies. The cutoff values of the moderate and severe dysphagia classifications did not present good sensitivity, but they were very close to them (above 0.7), thus presenting a tendency towards good sensitivity. The cutoff values obtained for the classification of mild dysphagia presented an unsatisfactory sensitivity for both consistencies. As such, the proposed scale is able to differentiate between patients with and without dysphagia, since it demonstrate a good ability to differentiating normal or functional swallow from dysphagia. This differentiation may favor the specialized therapeutic intervention. The trend towards good sensitivity for the moderate and severe dysphagia classifications has shown that the scale tends to assist the clinician in establishing these classifications. The authors believe that an increase in the number of children assessed could increase the sensitivity score above 0.8 for these categories. As for the classification of mild dysphagia, the proposed instrument presented a low capacity to establish this degree of alteration. The authors believe that this is due to the poor clinical impact that a mild dysphagia may have on both pulmonary and nutritional aspects. In addition, the increase in the number of children and a modification of some items in the scale, could contribute to a better sensitivity for this classification. Benfer *et al.,* (2012) in a systematic literature review regarding the clinical measures used in dysphagia in CP, stated that there is no specific description of dysphagia in this population, besides the absence of standardized or universally agreed-upon criteria in the definition of parameters and performances. Other studies also stated that there are few evaluation scales in pediatric dysphagia and that there is no agreement on criteria for classification of dysphagia severity in individuals with CP (Sellers *et al.,* 2014; Heckathorn *et al.,* 2016; Speyer *et al.,* 2018). The relationship between the score values produced by the scale and the swallowing clinical classifications was verified without establishing cutoff points. There was an increase in the score averages according to the increased severity of dysphagia, with a significant difference between them. The increase in the score due to worsening of swallowing showed that the scale can also be used as an efficient indicator of severity progression. Other functions of the stomatognathic system, such as chewing, sucking or other items of swallowing are aspects frequently evaluated by the SLP and can complement the data regarding the feeding of children with CP. These aspects are also important in defining therapeutic goals, however, the classification of swallowing is promoted by the items selected for the proposed scale. The limitations of this study were the number of children evaluated and the lack of other clinical dysphagia scales in CP, to compare our results. Although the proposed scale was effective in identifying dysphagia and tends to diagnose the most serious conditions, further studies are needed to optimize its efficiency in the establishment of cutoff points and in the identification of mild dysphagia.

## Conclusion

The proposed scale presented high internal consistency and reproducibility values, with satisfactory index of reproducibility; demonstrated to be an efficient instrument in differentiating children with CP with or without dysphagia and to be a possible indicator of severity progression for dysphagia in CP.

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