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THE EFFECT OF POSTURAL MANEUVERS ON SAFETY AND EFFICIENCY OF SWALLOWING IN PEOPLE WITH HEAD AND NECK CANCER: A CROSS-SECTIONAL STUDY

O EFEITO DAS MANOBRAS POSTURAIS NA SEGURANÇA E EFICÁCIA DA DEGLUTIÇÃO EM PESSOAS COM CANCRO DE CABEÇA E PESCOÇO: UM ESTUDO TRANSVERSAL

Relatório de Projeto de Investigação do
Mestrado em Terapia da Fala

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Resumo

Introdução: A maioria das pessoas com cancro de cabeça e pescoço (pCCP) apresenta perturbações da deglutição (PD). As manobras posturais são medidas de intervenção frequentemente utilizadas durante a deglutição e consideradas potencialmente benéficas. Contudo, poucos estudos apresentam avaliação às cegas e a maioria apresenta amostras de dimensão reduzida. Assim, o presente estudo pretende colmatar essas lacunas e tem como objetivo avaliar os efeitos das manobras posturais na segurança e eficácia da deglutição em pCCP com PD. **Métodos**: Foi conduzido um estudo observacional analítico em 48 pCCP com PD. Foi realizada uma videoendoscopia da deglutição com líquidos finos (IDDSI 0) e extremamente espessos (IDDSI 4), segundo a *International Dysphagia Diet Standardisation Initiative* (IDDSI). Para cada consistência, os participantes deglutiram três ofertas de 5 mL e realizaram as seguintes manobras: posição neutra (controlo), flexão, extensão e rotação da cabeça. Dois avaliadores externos analisaram às cegas a segurança e eficácia da deglutição através da *Penetration-Aspiration* (PAS) e *Yale Pharyngeal Residue Severity Rating* (YPRSRS). Para análise estatística utilizou-se uma ANOVA de medidas repetidas. **Resultados**: A flexão de cabeça melhorou a segurança da deglutição reduzindo os valores PAS (p = .046), enquanto a extensão piorou (p = .002), obtendo-se valores PAS significativamente mais elevados para IDDSI 0. Não se observaram diferenças significativas para o IDDSI 4. A extensão aumentou os resíduos nas valéculas com IDDSI 0 (p = .008) e IDDSI 4 (p < .001), bem como os resíduos nos seios piriformes para IDDSI 4 (p = .002). A rotação de cabeça aumentou o resíduo valecular (p = .041; p = .031). **Conclusão**: A flexão de cabeça diminuiu o nível de penetração-aspiração para IDDSI 0, enquanto a extensão e rotação de cabeça pioraram a segurança e eficácia da deglutição, salientando que as manobras compensatórias devem ser avaliadas individualmente em pCCP.

Palavras-chave: Manobras posturais; Perturbações da deglutição; Deglutição; Cancro de Cabeça e Pescoço; Videoendoscopia da deglutição.

Abstract

Purpose: Most people with head and neck cancer (pwHNC) experience swallowing disorders. Postural maneuvers are widely used intervention strategies during swallowing and are considered potentially beneficial. However, few studies employ blinded assessments, and most involve small sample sizes. Therefore, the present study aims to address these gaps and to evaluate the effects of postural maneuvers on swallowing safety and efficiency in pwHNC. **Methods**: An analytical observational study was conducted in 48 pwHNC with swallowing disorders. The assessment was performed using fiberoptic endoscopic evaluation of swallowing with thin (level 0) and extremely thick (level 4) liquids, following the International Dysphagia Diet Standardisation Initiative (IDDSI). For each consistency, participants completed three 5 mL boluses in five postural maneuvers: neutral (control), chin tuck, head extension, and head rotation to the right and left. Two blinded raters independently scored performance using the Penetration-Aspiration Scale (PAS) and the Yale Pharyngeal Residue Severity Rating Scale (YPRSRS). For statistical analysis, repeated measures ANOVA was used. **Results**: The chin tuck improved swallowing safety (p = .046), showing reduced PAS scores, whereas head extension worsened it (p = .002), with higher PAS scores for IDDSI level 0. No significant safety differences were observed for IDDSI level 4. Regarding efficiency, head extension increased vallecular residue for IDDSI level 0 (p = .008) and IDDSI level 4 (p < .001), and also raised pyriform sinus residue for IDDSI level 4 (p = .002). Head rotation increased vallecular residue (p = .041; p = .031) **Conclusion**: Findings reinforce the chin tuck's role in enhancing airway protection, especially with thin liquids. Conversely, head extension and rotation may compromise swallowing safety and efficiency, suggesting the need for individualized compensatory strategies in pwHNC.

Keywords: Postural maneuvers; Swallowing disorders; Swallowing; Head and Neck Cancer; Fiberoptic Endoscopic Evaluation of Swallowing.

Lista de abreviaturas

HNC – Head and Neck Cancer

pwHNC – People with Head and Neck Cancer

RT – Radiotherapy

CRT – Chemo-radiotherapy

ENT – Ear, Nose and Throat

FEES – Fiberoptic Endoscopic Evaluation of Swallowing

VFSS – Videofluoroscopic Swallowing Study

SLP – Speech Language Pathologist

MMSE – Mini-Mental State Examination

HEM – Hospital de Egas Moniz

ULSLO – Unidade Local de Saúde de Lisboa Ocidental

IDDSI – International Dysphagia Diet Standardisation Iniciative

PAS – Penetration-Aspiration Scale

YPRSRS - Yale Pharyngeal Residue Severity Rating Scale

NGT – Nasogastric Tube

PEG - Percutaneous Endoscopic Gastrostomy

HR(I)M – High-Resolution (Impedance) Manometry

UES – Upper Esophageal Sphincter

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3. Introduction

Head and neck cancers (HNC) are among the most common malignancies worldwide, with an estimated annual incidence of 660,000 to 890,000 new cases and more than 325,000 deaths (Bray et al., 2020; Gordon & Reiter, 2015; Gormley et al., 2022; Govender et al., 2017; Sung et al., 2021). Tumors of the oral cavity are the most prevalent globally, representing approximately 40–50% of all HNC cases, while HNC of the laryngeal subsite represents 15-25%, and HNC of the pharyngeal subsite (including nasopharyngeal, oropharyngeal, and hypopharyngeal subsites) collectively represent around 25-35% (Shield et al., 2017; Gatta et al., 2023). These distributions show substantial geographical variability in prevalence, anatomical patterns, and associated risk factors (Baijens et al., 2020; Gatta et al., 2023; Shield et al., 2017; Sung et al., 2021).

In Portugal, according to GLOBOCAN 2022, approximately 3,066 new HNC cases and 1,339 deaths were reported, with oral cavity and laryngeal cancers being the most frequent (Ferlay et al., 2024). Although HNC represent a relatively small proportion of total cancer cases nationally, they constitute a significant public health concern, particularly among males and populations with high tobacco and alcohol consumption. Etiologically, oral cavity cancers remain strongly associated with tobacco and alcohol use, oropharyngeal cancers show an increasing burden linked to HPV infection, and nasopharyngeal carcinoma displays an endemic distribution related to Epstein–Barr virus infection (Bray et al., 2020; Bizri et al., 2023; Gormley et al., 2022; Johnson et al., 2020; Sung et al., 2021).

Among the complications of HNC, swallowing disorders are highly prevalent, affecting 60-75% of people with HNC (pwHNC) (Govender et al., 2017). They may result from HNC-related burden, which may stem from the tumor itself, but are predominantly iatrogenic, resulting from oncological interventions, including surgery, radiotherapy (RT), or chemo-radiotherapy (CRT) (Barbon et al., 2020; Govender et al., 2024). Surgical resections may compromise key structures for chewing and swallowing, whereas (C)RT can lead to acute toxicities such as fatigue, mucositis and xerostomia, as well as late toxicities including fibrosis,

muscle atrophy, reduced oropharyngeal sensitivity, osteoradionecrosis, and neuropathy, all of which can compromise swallowing biomechanics (Barbon et al., 2020; Chen et al., 2020; Chiu et al., 2022; Govender et al., 2024; Grover & Sinha, 2020; Langmore & Krisciunas, 2010). The consequences are clinically significant, encompassing malnutrition, dehydration, aspiration pneumonia, and negative psychosocial outcomes, such as isolation and depression (Ekberg, 2019; Govender et al., 2017; Huppertz et al., 2018).

Structural loss or peripheral nerve injury resulting in paresis or paralysis can severely disrupt swallowing, affecting bolus control, pharyngeal propulsion, laryngeal elevation, and airway protection, particularly after surgical resection or oncological treatment for head and neck cancer (Pauloski, 2008; Clarke et al., 2016). These deficits increase the risk of penetration and aspiration due to impaired neuromuscular coordination and reduced airway closure. In response, compensatory strategies, such as postural maneuvers (e.g., chin-down, head extension and head rotation) are widely used to guide bolus flow, support remaining swallowing function, and protect the airway, without repairing the underlying anatomical deficits (Logemann et al., 1989; Clarke et al., 2016). Although these interventions are compensatory, they may play a crucial role in managing swallowing disorders in pwHNC with impaired lower airway protection by addressing the functional consequences of structural loss or peripheral paresis and reducing aspiration risk. (Clarke et al., 2016).

Critical care pathways and structured rehabilitation programs have been shown to improve clinical outcomes in pwHNC undergoing interventions, including reduced post-operative complications and shorter hospital stays (Gordon & Reiter, 2015; Moreno & Bonilla-Velez, 2019). Nonetheless, post-intervention in swallowing disorders remains a significant challenge, as adherence to prescribed swallowing exercises is often limited, despite their proven benefits for long-term functional recovery (Govender et al., 2017, 2024).

A limited but growing body of literature suggests that compensatory swallowing strategies, particularly postural maneuvers, may provide an important short-term contribution to enhancing swallowing safety and efficiency following

HNC interventions (Ambiado-Lillo, 2025; Kelly et al., 2019; Kumai et al., 2019; Logemann et al., 1994). Evidence suggests that specific maneuvers (e.g., chin tuck, head extension, head rotation) may have a positive effect on swallowing functionality (Ambiado-Lillo, 2025; Kelly et al., 2019; Kim et al., 2015; Kumai et al., 2019; Lee et al., 2018; Logemann et al., 1994; Solazzo et al., 2012; Terré & Mearin, 2012). Such strategies can facilitate safer and more effective bolus transit, supporting pwHNC in maintaining oral intake during the early stages of rehabilitation (Ertekin et al., 2001; Govender et al., 2017, 2024). Postural maneuvers may also serve as a valuable complement to structured rehabilitation, bridging the gap between acute post-intervention impairments and long-term functional recovery while supporting behavioral and exercise-based interventions aimed at enhancing patient adherence and outcomes (Govender et al., 2017; Gordon & Reiter, 2015; Van der Molen et al., 2018; Van den Steen et al., 2020; Zhang et al., 2022).

Some studies suggest that maneuvers such as chin tuck, head rotation, and head extension can reduce penetration and aspiration in people with neurogenic swallowing disorders, although effectiveness varies considerably across individuals (Ambiado-Lillo, 2025; Lee et al., 2018; Solazzo et al., 2012; Terré & Mearin, 2012). Furthermore, physiological studies in healthy volunteers also demonstrate that head and neck positioning significantly change muscular coordination and pharyngeal pressure events, supporting a mechanistic rationale for their clinical application (Ertekin et al., 2001; Kim et al., 2015).

Despite the encouraging findings about the positive effects of postural maneuvers in swallowing safety and efficiency, a recent systematic review also emphasized the substantial methodological heterogeneity and limited sample sizes of these studies (Ambiado-Lillo, 2025; Kelly et al., 2019). Findings also show that postural maneuvers may reduce aspiration risk in a certain subgroup of patients, although their effectiveness varies according to the underlying swallowing biomechanics and etiology-specific mechanisms. Neurogenic cohorts show moderate, selective benefits, particularly for chin-tuck (Ambiado-Lillo, 2025; Saconato et al., 2016; Ayres et al., 2017; Forbes et al., 2021). Overall, current

literature supports the role of postural maneuvers as rapid, low-cost compensatory strategies in neurogenic swallowing disorders, while also highlighting the need for more rigorous and standardized research designs.

Conversely, the literature addressing HNC populations is scarce. To our knowledge, one of the few published studies demonstrated that postural maneuvers, including chin tuck, head rotation, and head extension, can reduce the risk of aspiration during swallowing in pwHNC who underwent surgical treatment (n = 32). Among these maneuvers, the chin tuck was the most consistently effective across various surgical subgroups, whereas head rotation showed variable effectiveness, and head extension proved beneficial in a small subgroup involving the oral cavity subsite (n = 3). These findings suggest that targeted postural maneuvers may acutely facilitate safe oral intake (Logemann et al., 1994).

Complementary evidence from surgical oncology cohorts, such as people undergoing esophagectomy, indicates that maneuvers like chin-tuck may reduce airway invasion and pharyngeal residue in cases with impaired airway closure, further supporting a mechanism-specific benefit (Kumai et al., 2019).

Although postural maneuvers are widely used, the current body of evidence on postural maneuvers in pwHNC is methodologically limited and should be interpreted with caution. Common limitations across studies include small sample sizes, heterogeneous populations, non-randomized designs, and absence of blinded evaluation, all of which compromise internal and external validity. Furthermore, there is considerable variability in bolus volumes, consistencies, instrumental assessment methods (e.g., videofluoroscopic swallowing study [VFSS] or fiberoptic endoscopic evaluation of swallowing [FEES]) and administration protocols, as well as inconsistent use of standardized outcome measures, which obscures the independent effect of any specific posture (Ambiado-Lillo, 2025). Many studies combine multiple maneuvers and focus predominantly on short-term physiological outcomes, limiting both interpretability and conclusions regarding long-term functional benefits. Taken together, while postural maneuvers hold promise as compensatory strategies, their clinical utility

in pwHNC remains insufficiently defined, highlighting the need for high-quality, population-specific studies to establish efficiency and sustained functional improvement.

Overall, the literature supports individualized, mechanism-guided trials during instrumental assessment, while highlighting the need for larger, controlled, blinded studies in pwHNC with standardized bolus protocols and clinically meaningful outcomes (Ambiado-Lillo, 2025). Although previous studies have explored individualized, mechanism-guided trials during instrumental swallowing assessment, they are often limited by small sample sizes, lack of control groups, and heterogeneous bolus protocols. Taken together, these limitations hinder the generalizability of findings and the accuracy of evidence-based recommendations in pwHNC with swallowing disorders. The present study aims to address these gaps by systematically evaluating the effect of different postural maneuvers on swallowing safety and efficiency, using standardized assessment procedures and outcome measures in pwHNC with swallowing disorders.

4. Methods

4.1. Study design

An analytical cross-sectional observational study was conducted.

4.2. Participants

A total of 48 pwHNC were included in this study, selected by convenience, using a non-probabilistic sampling technique. Participants were eligible according to the following inclusion criteria: (i) diagnosis of HNC established by an Ear, Nose and Throat (ENT) physician; and (ii) diagnosis of swallowing disorders established based on Fiberoptic Endoscopic Evaluation of Swallowing (FEES) by an ENT physician and a Speech Language Pathologist (SLP). Those meeting these inclusion criteria were subsequently screened for exclusion criteria, which encompassed: (i) concomitant causes of swallowing disorders (e.g., stroke, traumatic brain injury, chronic obstructive pulmonary disease); (ii) total laryngectomy; or (iii) cognitive impairment, with efforts to address potential sources of bias. To ensure that participants had the cognitive ability to understand

how to perform the task, cognitive status was screened using the Mini-Mental State Examination (MMSE), applying literacy-adjusted cutoff scores (O'Connor et al., 1989; Santana et al., 2016).

4.3. Sample size

Previous studies that evaluated the effects of postural maneuvers on swallowing function in multiple populations with swallowing disorders have typically included small to moderate sample sizes, ranging from 20 to 47 participants (Lee et al., 2018; Logemann et al., 1994; Terré & Mearin, 2012; Kumai et al., 2019).

To ensure adequate statistical power for the analyses to detect meaningful effects in the current study, a formal sample size calculation was performed by using GPower 3.1. Based on one-way repeated-measures ANOVA, a significance level of $\alpha = .05$, a statistical power of .80 (1-β error probability), and a medium effect size ($f = .25$), a minimum of 21 participants ($n = 21$) was required to detect statistically significant differences in the primary outcomes.

This study included 48 participants to strengthen the reliability and robustness of the findings, increase statistical power, improve the precision of estimates, enhance the generalizability of the results, and reduce the impact of potential participant dropout.

To determine the required sample size for a mixed ANOVA with two groups and two measurements with a significance level of $\alpha = .05$, a statistical power of .80 (1-β error probability), a medium effect size ($f = .25$), and an assumed correlation of .50 between repeated measures, the analysis indicated that a total sample size of 98 participants would be necessary. However, recruiting this number for this study was not feasible due to logistical constraints of the HEM-ULSLO and the project timeline.

4.4. Settings

All participants were recruited through the Head and Neck Cancer clinic of the ENT Department at Hospital de Egas Moniz (HEM), Unidade Local de Saúde de Lisboa Ocidental (ULSLO). The principal investigator (SLP-GB) contacted

potential participants via telephone and e-mail to provide detailed information about the study's objectives and procedures. Written informed consent was subsequently obtained from all participants before their inclusion in the study, who were provided with a study information sheet.

4.5. External raters

Two external raters (ENT-FC and ENT-SC) were recruited to blindly assess participants' swallowing safety and efficiency using the primary outcome measures. The selection of raters was based on the following criteria: (i) being a SLP or an ENT physician; (ii) more than five years of clinical experience in the field of swallowing disorders; (iii) specific training in swallowing disorders; (iv) at least five years of experience in FEES; and (v) at least five years of clinical experience in HNC.

4.6. Study procedures

Each participant underwent a FEES, performed by the team of ENT physicians following the study protocol, with food trials administered by the SLP (GB). FEES was chosen for this study due to its established utility in both clinical and research contexts, allowing direct visualization of pharyngeal and laryngeal structures and thorough assessment of airway protection and bolus flow, which is particularly relevant for analyze the effects of postural maneuvers on swallowing safety and efficiency.

FEES were performed using the VIVIDEO Video ENT Endoscope [VNL9-CP], HD (CP Series), with an outer diameter of 3.3 mm and a working length of 300 mm (VIVIDEO System). Image recording was conducted using the VIVIDEO Pentax Medical CP-1000 system.

Swallowing was assessed using thin (Level 0) and extremely thick (Level 4) liquids according to the International Dysphagia Diet Standardisation Initiative (IDDSI). Both liquids were colored with gel food dyes to allow clear differentiation during the FEES. The thin liquid (IDDSI level 0) was colored white, using 10 mL of white gel dye (Ref.: FAB16010306) per 100 mL of water, while extremely thick liquid (IDDSI level 4) was colored green, prepared with Nutilis Clear® thickener

(Nutricia, Ref.: 7471672) and 1 mL of green gel dye (Ref.: 191007668) per 100 mL of water.

The liquids were evaluated using the IDDSI Flow Test, a standardized method for assessing consistency, before the FEES procedure. A 10 mL IDDSI funnel (Steele et al., 2024) was used to perform the test, and each sample successfully passed, indicating compliance with the IDDSI criteria. All liquids were provided at room temperature to standardize testing conditions.

Both liquids were administered using an enteral feeding syringe (Ref.: C60ML) to ensure precise control of the bolus volume and were introduced into the oral cavity, positioned anteriorly, in the anterior region of the tongue. Participants were seated in a chair, in an upright position at approximately 90°, with the trunk aligned in midline, which was continuously monitored and adjusted by the SLP (GB) to maintain standardization throughout the procedure.

Participants completed three 5 mL swallows per consistency in five postural conditions: neutral head position (control), chin tuck, head extension, and head rotation to the right and left side (i.e., affected versus unaffected side). The sequence of instructions provided by the SLP (GB) for the performance of the maneuvers was maintained across all trials.

The instructions were as: (i) neutral head position - ‘swallow’; (ii) chin tuck ‘chin to chest - swallow’; (iii) head extension - ‘chin up - swallow’; (iv) head rotation to the right - ‘turn your head to the right, chin toward the right shoulder - swallow’; and (v) head rotation to the left - ‘turn your head to the left, chin toward the left shoulder - swallow’.

Prior to the FEES, participants practiced the maneuvers under the guidance of the SLP (GB) to become familiar with the procedures.

At an initial stage, all postural maneuvers were tested in the previously described order, with three 5 mL boluses of thin liquid (IDDSI level 0) administered for each maneuver. After completing all trials with IDDSI level 0, all maneuvers were tested again in the same order, with three 5 mL boluses of extremely thick liquid (IDDSI level 4) administered per maneuver. A rest period of

30 seconds was provided between each swallowing attempt to minimize fatigue and ensure consistency across conditions.

Figure 1 provides a schematic representation of the procedures followed throughout the study.

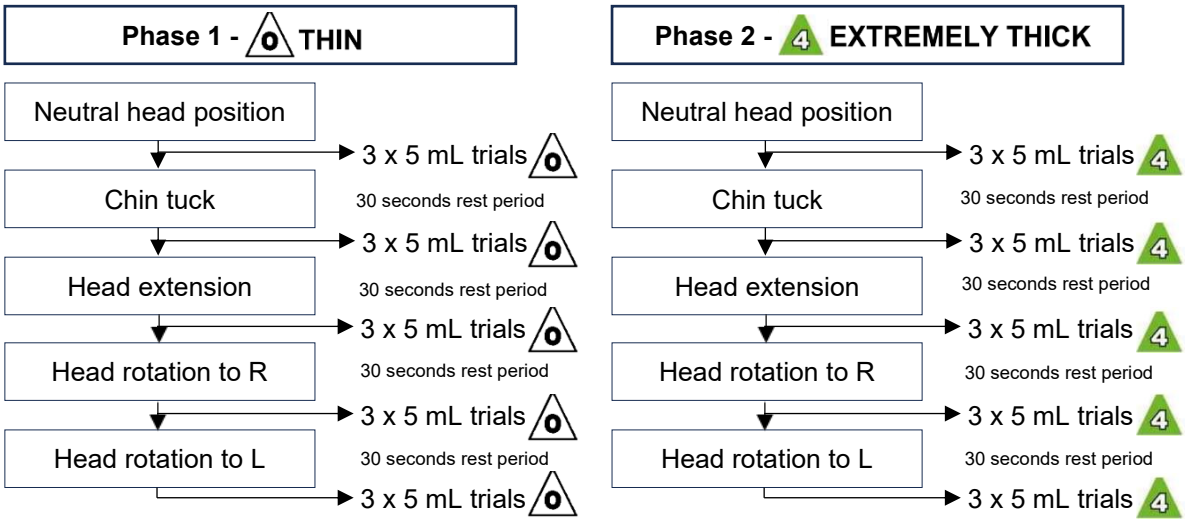

Figure 1. Flowchart of study procedures. Note: R = Right; L = Left.

Outcomes measures were independently scored using visual analysis of FEES recordings by two external raters (ENT-FC and ENT-SC) to verify the stability and reliability of measurements. The result of the worst trial was considered for each condition, defined as the swallow showing the poorest functional performance based on the primary outcome measures. Both raters were blinded to the participant and postural maneuver and accessed FEES recordings through password-protected secure links, which allowed visualization only of the relevant anatomical structures (e.g., base of the tongue, epiglottis, valleculae, arytenoids, pyriform sinuses, laryngeal vestibule, vocal folds, pharyngeal walls, and upper esophageal sphincter).

Data collection was conducted between March and August 2025 at the ENT Department of HEM-ULSLO during scheduled clinical visits. Data confidentiality was ensured through storage in a password-protected institutional database with restricted access. Each participant was assigned a unique code (e.g., P-001), guaranteeing anonymity. All analyses were performed under blinded conditions

to ensure that participants could not be identified. The study protocol was reviewed and approved by the Health Ethics Committee of ULSLO [n.º 2025-9].

4.7. Instruments

Through a sociodemographic and clinical data collection form, relevant information was collected to characterize the sample (e.g., sex, age, location, and staging of HNC, type of intervention: surgery, CRT or RT, presence or absence of allergies, and feeding-related issues such as swallowing disorders, and oral versus enteral feeding).

Cognitive screening was conducted using the Mini-Mental State Examination (MMSE) to ensure that participants could understand instructions for performing the postural maneuvers. The MMSE serves as a cognitive screening tool, assessing six cognitive domains: (i) orientation; (ii) repetition, (iii) verbal recall; (iv) attention and calculation; (v) language; and, (vi) visuospatial/constructional ability, and takes approximately 5-10 minutes to complete (O'Connor et al., 1989; Guerreiro et al., 1994; Santana et al., 2016). Literacy-adjusted cutoff scores were applied in accordance with the Portuguese normative adaptations (Santana et al., 2016).

4.8. Primary Outcomes

The Penetration-Aspiration Scale (PAS) is a standardized 8-point ordinal scale used to characterize laryngeal-tracheal penetration and aspiration, as well as the response to material entering the airway. It was originally developed for videofluoroscopic swallow studies (Rosenbek et al., 1996) and has also been applied during FEES in later research (Butler et al., 2015). Scores range from 1 (material does not enter the airway) to 8 (material passes below the vocal folds with no attempt to eject), with lower scores reflecting less penetration and aspiration. The PAS has demonstrated acceptable intra- and inter-rater reliability (Borders & Brakes, 2020; Rosenbek et al., 1996).

The Yale Pharyngeal Residue Severity Rating Scale (YPRSRS) is a standardized 5-point ordinal scale used to assess the severity of post-swallow residue during FEES, specifically in the vallecula and pyriform sinuses, based on

imaging. Scores range from 1 (none) to 5 (severe), with lower scores indicating less severe post-swallow residue, whereas higher scores indicate more severe residue. The YPRSRS demonstrates excellent intra- and inter-rater reliability (Neubauer et al., 2015; Silva-Carvalho et al., 2024).

4.9. Bias

Efforts to minimize potential sources of bias included the use of blinded external raters for primary outcome measures, the provision of standardized protocol instructions, and the consistent execution of postural maneuvers (e.g., controlling participant posture throughout FEES), and standardized trials of bolus volumes and consistencies. All FEES recordings were evaluated independently, with raters having no access to participant identity or the specific postural maneuver. Additionally, cognitive screening using the MMSE was conducted to ensure that all participants were able to reliably follow instructions, thereby minimizing variability related to differences in task comprehension (e.g., in the execution of the postural maneuvers). Participants also underwent prior training regarding the performance of the maneuvers. All procedures were performed by SLP-GB to ensure greater consistency in their execution.

4.10. Data analysis

Statistical analyses were performed using the IBM SPSS Statistics 30.0.0 for Windows. Data analysis comprised both descriptive and inferential statistics.

Descriptive statistics were performed to characterize sociodemographic and clinical data of participants, including sex, age, HNC location and staging, type of intervention (e.g., surgery, CRT, or RT) and swallowing-related variables such as, oral versus enteral feeding (e.g., nasogastric tube [NGT]; or percutaneous endoscopic gastrostomy [PEG]).

Inferential analyses were conducted by using repeated-measures ANOVA to compare the total mean scores across primary outcome measures (i.e., PAS and YPRSRS), and to evaluate the effect of postural maneuvers on swallowing safety and efficiency. The within-subject factor was the postural maneuvers, with levels corresponding to the different maneuvers being compared (e.g., neutral

head position; chin tuck, head extension; head rotation to the right and left side). Post-hoc comparisons were adjusted by using the Sidak correction to control for multiple pairwise comparisons (Field, 2018; Tabachnick & Fidell, 2019; Sidak, 1967).

A mixed-designed ANOVA was performed to assess the effect of head rotation direction and the laterality of the primary tumor on swallowing safety and efficiency. The within-subjects factor was the rotation direction (e.g., neutral head position, head rotation to the right and left side), and the between-subjects factor was the HNC location (e.g., affected and unaffected side).

Inter-rater reliability was assessed using the Weighted Kappa coefficient to account for partial agreement between raters (Cohen, 1968). Cohen's Kappa coefficient (κ) was interpreted according to Landis and Koch (1977), where values < 0 indicate poor agreement, 0-.20 slight agreement, .21-.40 = fair agreement, .41-.60 moderate agreement, .61-.80 substantial agreement, and .81-1.00 almost perfect agreement.

Regarding the analysis of the effect of postural maneuvers using repeated-measures ANOVA, when Mauchly's test indicated a violation of sphericity, Greenhouse-Geisser corrections were applied, providing a robust measure of agreement across the primary outcome measures.

All analyses included the entire sample (n = 48), except for those assessing the effects of head rotation maneuvers and the HNC laterality (e.g., affected and unaffected sides) on swallowing safety and efficiency. Given that most participants underwent bilateral radiotherapy, they were grouped according to the laterality of the primary tumor, with pwHNC presenting bilateral tumors (n = 6) excluded from these analyses. Only participants with a clear unilateral primary tumor were included in this analysis (n = 42).

A significance level of $p < .05$ and a 95% confidence interval were adopted for all statistical analyses.

5. Results

5.1. Descriptive data

Forty-eight pwHNC were enrolled in this study, of whom 85.4% were male, and the majority had tumors located in the larynx, followed by oral cavity, oropharynx, hypopharynx, and nasopharynx. Most participants (77.1%) presented with advanced-stage HNC (M = 2.74, SD = .95).

The mean age was 64.96 years, ranging from 37 to 87 years. Regarding the type of feeding, 77.1% were receiving oral intake, 12.5% were receiving enteral feeding via NGT, and 10.4% via PEG. Concerning surgical interventions, 64.6% did not undergo any head or neck surgery. Additionally, 87.5% of participants underwent RT, with all receiving bilateral irradiation of ≥ 60 grays (Gy) delivered over 30-35 sessions, being the standard of 33 RT-sessions. Regarding RT, the Tx cases underwent radiotherapy encompassing the entire aerodigestive tract, including the nasopharynx, oropharynx, and hypopharynx. All participants met the MMSE cognitive screening criteria, scoring above the literacy-adjusted cutoff values according to the Portuguese normative data (Santana et al., 2016).

Table 1 provides a detailed overview of the sample's sociodemographic characteristics.

Table 1. *Sociodemographic characterization of the sample.*

	Participants *(n = 48)*
Sex n | %	
Male	41 | 85.4
Female	7 | 14.6
Age n | %	
Mean ± SD	64.96 ± 10.04
Minimum-Maximum	37-87
Level of education (ISCED classification) n | %	
Primary school education (0-4)	23 | 47.9
Secondary school education (5-12)	21 | 43.8
Tertiary education (graduation/postgraduation)	4 | 8.3
MMSE score n | %	
Mean ± SD	28.08 ± 2.18
MMSE ≥ cutoff	48 | 100
HNC location n | %	
Larynx	16 | 33.3
Oral cavity	11 | 22.9

Oropharynx	10 | 20.8
Hypopharynx	6 | 12.5
Nasopharynx	3 | 6.3
Unknown	2 | 4.2
TNM classification n | %	
Tumour n | %	
Tx	2 | 4.2
T1	5 | 10.4
T2	13 | 27.1
T3	17 | 35.4
T4	11 | 22.9
Nodes n | %	
N0	21 | 43.8
N1	7 | 14.6
N2	16 | 33.3
N3	4 | 8.3
Metastasis n | %	
M0	45 | 93.7
M1	3 | 6.3
Staging n | %	
Early (i.e., stage I or II)	11 | 22.9
Advanced (i.e., stage III or IV)	37 | 77.1
Surgical intervention n | %	
None	31 | 64.6
Cordectomy	3 | 6.3
Pelvectomy	1 | 2.1
Pelveglossectomy	9 | 18.8
Partial glossectomy	3 | 6.3
Maxillectomy	1 | 2.1
Cervical lymph node dissection n | %	
Yes	11 | 23.1
No	37 | 76.9
HNC laterality n | %	
Left	17 | 35.4
Right	25 | 52.1
Bilateral	6 | 12.5
Radiotherapy n | %	
Yes	42 | 87.5
No	6 | 12.5
Feeding mode n | %	
Oral	37 | 77.1
NGT	6 | 12.5
PEG	5 | 10.4

SD = Standard Deviation; ISCED = International Standard Classification of Education; Unknown = metastases from an occult primary tumor (Tx). MMSE = Mini-Mental State Examination; HNC = Head and Neck Cancer; NGT = Nasogastric tube. PEG = Percutaneous Endoscopic Gastrostomy. In pwHNC with oral cavity subsite, 4.2% underwent marginal mandibulectomy with pelveglossectomy, and 8.4% received flap reconstruction.

5.2. Inter-raters' reliability

For PAS with IDDSI level 0, inter-rater agreement was moderate, while for PAS with IDDSI level 4, agreement ranged from moderate to substantial. Regarding the YPRSRS scores, inter-rater agreement for vallecular residue with IDDSI level 0 varied from poor to fair, while pyriform sinuses residue ranged from fair to moderate. For IDDSI 4, vallecular residue agreement ranged from fair to moderate, and pyriform sinuses residue agreement was moderate.

Table 2 summarizes the inter-rater agreement for the PAS and YPRSRS at IDDSI levels 0 and 4.

Table 2. *Inter-rater agreement for PAS and YPRSRS with IDDSI level 0 and 4.*

Postural maneuvers	***κ***	***95% CI***	***p-value***	***Strength of agreement***
PAS with IDDSI level 0				
Neutral	.561	[.434, .688]	<.001	Moderate
Chin tuck	.602	[.482, .721]	<.001	Moderate
Head extension	.423	[.287, .558]	<.001	Moderate
Head rotation to R side	.461	[.319, .604]	<.001	Moderate
Head rotation to L side	.584	[.451, .718]	<.001	Moderate
PAS with IDDSI level 4				
Neutral	.562	[.395, .728]	<.001	Moderate
Chin tuck	.558	[.356, .759]	<.001	Moderate
Head extension	.579	[.436, .722]	<.001	Moderate
Head rotation to R side	.647	[.527, .768]	<.001	Substantial
Head rotation to L side	.693	[.585, .801]	<.001	Substantial
YPRSRS vallecular residue with IDDSI level 0				
Neutral	.271	[.060, .482]	.001	Fair
Chin tuck	.086	[-.108, .280]	.324	Poor
Head extension	.182	[-.019, .383]	.032	Poor
Head rotation to R side	.100	[-.0.50, .251]	.180	Poor
Head rotation to L side	.219	[.040, .399]	.009	Fair
YPRSRS pyriform sinuses residue with IDDSI level 0				
Neutral	.556	[.403, .708]	<.001	Moderate
Chin tuck	.356	[.180, .531]	<.001	Fair
Head extension	.329	[.165, .494]	<.001	Fair
Head rotation to R side	.284	[.099, .468]	.002	Fair
Head rotation to L side	.252	[.035, .468]	.006	Fair
YPRSRS vallecula residue with IDDSI level 4				

Neutral	.385	[.221, .549]	<.001	Fair
Chin tuck	.314	[.143, .486]	<.001	Fair
Head extension	.415	[.257, .572]	<.001	Moderate
Head rotation to R side	.323	[.163, .483]	<.001	Fair
Head rotation to L side	.376	[.220, .532]	<.001	Fair
YPRSRS pyriform sinuses residue with IDDSI level 4				
Neutral	.456	[.292, .621]	<.001	Moderate
Chin tuck	.477	[.264, .689]	<.001	Moderate
Head extension	.543	[.406, .608]	<.001	Moderate
Head rotation to R side	.594	[.434, .573]	<.001	Moderate
Head rotation to L side	.514	[.339, .690]	<.001	Moderate

κ = Cohen's Kappa coefficient. Interpretation according to Landis and Koch (1977); CI = Confidence Interval; PAS = Penetration-Aspiration Scale; IDDSI = International Dysphagia Diet Standardisation Initiative; YPRSRS = Yale Pharyngeal Residue Severity Rating Scale; R = Right side; L = Left side.

5.3. Swallowing safety

5.3.1 Thin liquid (IDDSI level 0)

Analysis revealed a significant effect of postural maneuvers on swallowing safety for IDDSI level 0, $F(3.38, 158.89) = 13.99$, $p < .001$, $\eta^2 = .229$. Post-hoc pairwise comparisons with Sidak correction indicated that the neutral head position differed significantly from both the chin tuck ($p = .046$) and head extension ($p = .002$) maneuvers (Table 3).

Considering only the comparisons involving the neutral head position for PAS with thin liquid (IDDSI level 0), statistically significant differences were observed in two anatomical locations. In pwHNC involving the hypopharynx, swallowing safety has significantly improved in the chin tuck compared to the neutral head position ($p = .031$). In pwHNC involving the larynx, a significant negative difference was also observed between the neutral head position and head extension ($p = .003$). In the remaining anatomical subsites, no statistically significant differences were observed (Supplementary Table S1).

No significant differences were observed between head rotation when compared to the neutral head position, considering the affected and unaffected sides.

5.3.2 Extremely thick liquid (IDDSI level 4)

For IDDSI level 4, the analyses also showed a significant effect of postural maneuvers, $F(4, 188) = 6.44$, $p < .001$, η^2 partial = .120. Nevertheless, no Sidak-adjusted pairwise comparisons, relative to the neutral head position, reached statistical significance. No statistically significant differences were observed when comparing the postural maneuvers to the neutral head position across HNC subsites (Supplementary Table S1).

Table 3 presents the effects of different postural maneuvers on swallowing safety across both IDDSI levels. The reported values are based on pairwise comparisons between the maneuvers.

Table 3. *Effect of postural maneuvers on swallowing safety across both IDDSI levels.*

Postural maneuvers	IDDSI	Mean ± SD	*t* (Sidak)	MD [95% CI]	*p*-value
Neutral	Level 0	4.22 ± 1.99	—	—	—
	Level 4	2.02 ± 1.69			
Chin tuck	Level 0	3.76 ± 2.11	.155	.458 [.004, .912]	.046*
	Level 4	1.73 ± 1.42	.114	.292 [-.044, .627]	.131
Head extension	Level 0	4.88 ± 1.85	.165	-.656 [-1.140, -.173]	.002*
	Level 4	2.24 ± 1.71	.132	-.219 [-.607, .170]	.669
Head rotation to R	Level 0	4.47 ± 1.96	.160	-.250 [-1.140, -.173]	.739
	Level 4	2.04 ± 1.63	.112	-.021 [-.351, .309]	1.000
Affected side	Level 0	4.44 ± 1.62	.233	-.280 [-.971, .411]	.933
	Level 4	1.92 ± 1.50	.161	-.020 [-.496, .456]	1.000
Unaffected side	Level 0	4.41 ± 2.20	.265	-.480 [-1.265, .305]	.554
	Level 4	2.12 ± 1.92	.177	-.160 [-684, .364]	.990
Head rotation to L	Level 0	4.44 ± 2.10	.188	-.219 [-.772, .334]	.945
	Level 4	2.11 ± 1.63	.130	-.094 [-.477, .289]	.998
Affected side	Level 0	4.12 ± 2.41	.321	-.059 [-1.011, .893]	1.000
	Level 4	2.18 ± 2.02	.214	-.147 [-.782, .488]	.999
Unaffected side	Level 0	4.64 ± 1.64	.213	-.353 [-1.191, .485]	.916
	Level 4	2.06 ± 1.46	.195	-.088 [-.666, .489]	1.000

IDDSI = International Dysphagia Diet Standardisation Initiative; SD = Standard Deviation; MD = Mean Diference; R = Right side; L = Left side. Note: Pairwise comparisons were performed using the Sidak adjustment for multiple comparisons. Values represent mean differences, test statistics (t), and adjusted *p*-values relative to the neutral head position (control). For the mixed-designed ANOVA analyzing head rotation toward the affected and unaffected sides, participants were categorized based on tumor laterality: left-sided HNC (n = 17) and right-sided HNC (n = 25).

5.4. Swallowing efficiency

5.4.1 Thin liquid (IDDSI level 0)

For YPRSRS vallecular residue with IDDSI level 0, the repeated-measures ANOVA revealed a significant main effect of postural maneuvers, $F(4, 188) = 4.26$, $p = .003$, η^2 partial = .083. Sidak-adjusted pairwise comparisons showed a

significant negative difference for head extension compared to neutral head position (p = .008), whereas no other comparisons were significant (Table 4).

For YPRSRS pyriform sinus residue with IDDSI 0, a significant effect was also observed, F(2.93, 137.70) = 6.82, p = .003, η^2 partial = .093. Nonetheless, sidak-adjusted comparisons did not reach statistical significance relative to the neutral head position (Table 4). No statistically significant differences were observed in YPRSRS vallecular residue across postural maneuvers and HNC subsites (Supplementary Table S1).

Conversely, significant differences were observed for YPRSRS pyriform sinuses residue. In pwHNC involving the laryngeal subsite, head extension was associated with higher residue scores compared to the neutral head position (p = .021). No significant differences were observed in other HNC subsites across postural maneuvers relative to the neutral head position (Supplementary Table S1).

5.4.2 Extremely thick liquid (IDDSI level 4)

For YPRSRS with IDDSI level 4, repeated-measures ANOVA with Greenhouse-Geisser corrections revealed a significant main effect of postural maneuvers on vallecular, F(2.52, 188.86) = 11.43, p < .001, η^2 partial = .196, and pyriform sinuses residue, F(3.37, 158.54) = 7.87, p < .001, η^2 partial = .143). Sidak-adjusted pairwise comparisons suggest that head extension (p < .001) and head rotation to the right (p = .041) and to the left (p = .031) resulted in a significant negative effect, increasing vallecular residue compared to neutral head position and chin tuck (Table 4).

Significant statistical effects were observed across anatomical HNC subsites (Supplementary Table S1). In pwHNC involving laryngeal and oral cavity subsite, head extension led to higher vallecular residue compared to neutral head position (p = .009; and, p = .041; respectively).

For pyriform sinuses residue, a significant main effect was observed, F(3.37, 158.54) = 7.87, p < .001, η^2 partial = .143. Sidak-adjusted comparisons revealed that head extension increased residue relative to the neutral head

position (p = .002), with significant differences observed in pwHNC involving laryngeal subsite (p = .042), where head extension led to higher residue compared to the neutral head position. No significant differences were observed in the other anatomical subsites of HNC (Supplementary Table S1).

Table 4 presents the YPRSRS scores for vallecular and pyriform sinus residue for both IDDSI levels.

Table 4. *YPRSRS scores for vallecular and pyriform sinuses residue for both IDDSI levels.*

Postural maneuvers	IDDSI	Mean ± SD	*t* (Sidak)	MD [95% CI]	*p*-value
YPRSRS score for vallecular residue					
Neutral	Level 0	2.27 ± 0.62	—	—	—
	Level 4	2.51 ± 0.91			
Chin tuck	Level 0	2.35 ± 0.53	.056	-.083 [-.249, .082]	.794
	Level 4	2.51 ± 0.93	.080	.000 [-.235, .235]	1.000
Head extension	Level 0	2.47 ± 0.58	.055	-.198 [-.360, .036]	.008*
	Level 4	2.99 ± 0.96	.100	-.479 [-.772, -.186]	<.001*
Head rotation to right	Level 0	2.39 ± 0.59	.048	-.115 [-.255, .025]	.184
	Level 4	2.84 ± 0.92	.111	-.333 [-.659, -.008]	.041*
Affected side	Level 0	2.42 ± 0.49	.068	-.060 [-.263, .143]	.992
	Level 4	2.86 ± 0.99	.149	-.420 [-.863, .023]	.073
Unaffected side	Level 0	2.41 ± 0.59	.081	-.040 [-.279, .199]	1.000
	Level 4	2.76 ± 0.83	.138	-.520 [-.928, -.112]	.005*
Head rotation to left	Level 0	2.43 ± 0.49	.062	-.156 [-.337, .025]	.137
	Level 4	2.85 ± 0.99	.111	-.344 [-.668, -.019]	.031*
Affected side	Level 0	2.47 ± 0.60	.098	-.294 [-.584, -.005]	.044*
	Level 4	2.56 ± 0.97	.167	.029 [-.465, .524]	1.000
Unaffected side	Level 0	2.40 ± 0.43	.083	-.206 [-.452, .040]	.162
	Level 4	2.96 ± 0.99	.181	-.176 [-.713, .360]	.983
YPRSRS score for pyriform sinuses residue					
Neutral	Level 0	2.10 ± 0.88	—	—	—
	Level 4	1.82 ± 0.90			
Chin tuck	Level 0	2.07 ± 0.76	.078	.031 [-.198, .260]	1.000
	Level 4	1.76 ± 0.89	.090	.063 [-.202, .327]	.999
Head extension	Level 0	2.32 ± 0.75	.083	-.219 [-.462, .024]	.106
	Level 4	2.24 ± 1.14	.105	-.417 [-.724, .110]	.002*
Head rotation to right	Level 0	2.23 ± 0.74	.075	-.125 [-.346, .096]	.663
	Level 4	1.98 ± 1.04	.094	-.156 [-.433, .121]	.668
Affected side	Level 0	2.18 ± 0.63	.100	-.120 [-.417, .177]	.934
	Level 4	1.82 ± 0.83	.119	-.140 [-.492, .212]	.941
Unaffected side	Level 0	2.26 ± 0.92	.123	-.160 [-.526, .206]	.896
	Level 4	2.21 ± 1.28	.131	-.240 [-.628, .148]	.537
Head rotation to left	Level 0	2.26 ± 0.64	.088	-.156 [-.416, .103]	.580
	Level 4	2.02 ± 1.07	.096	-.198 [-.327, .202]	.370
Affected side	Level 0	2.26 ± 0.81	.150	-.147 [-.591, .296]	.982
	Level 4	2.12 ± 1.18	.159	-.265 [-.735, .205]	.663
Unaffected side	Level 0	2.22 ± 0.54	.121	-.147 [-.507, .213]	.929
	Level 4	1.92 ± 0.99	.144	-.353 [-.780, .074]	.174

SD = standard deviation; MD = mean diference. Note: Pairwise comparisons were performed using the Sidak adjustment for multiple comparisons. Values represent mean differences, test statistics (t), and adjusted *p*-values relative to the neutral head position (control).

6. Discussion

The present study aimed at investigating the effect of postural maneuvers on swallowing safety and efficiency in pwHNC.

6.1. Reliability

Inter-rater agreement analyses indicated that PAS scores demonstrated higher reliability than YPRSRS measures. Overall, these findings suggest that inter-rater reliability improves with bolus thickness and is generally higher for PAS than for YPRSRS measures.

Previous studies have highlighted variability in the reliability of residue assessments in swallowing evaluation (Alkhuwaiter et al., 2021; Everton et al., 2022; Krishnan et al., 2024; Rocca et al., 2022, 2025). In this study, the weakest inter-rater reliability was observed for external raters assessing residue with IDDSI level 0. Specifically, lower agreement for vallecular and pyriform sinuses residue at this level may have been influenced by the white coloration of the bolus and the presence of whitish secretions following RT, which could have hindered accurate visualization and scoring of the YPRSRS. These findings of higher PAS reliability compared to the YPRSRS are consistent with Rocca et al. (2025), who reported greater inter-rater agreement for PAS when assessing thicker boluses. Thicker boluses (IDDSI level 4) are generally more visible and easier to control, making them less susceptible to premature spillage into the pharynx compared with thin liquids (IDDSI level 0), which facilitates more accurate scoring (Steele & Cichero, 2014; Steele et al., 2015).

Regarding differences in agreement between the vallecular and pyriform sinuses, vallecular residue may be particularly affected by post-RT secretions, making residue difficult to distinguish due to the similar white coloration (IDDSI level 0). Pyriform sinuses, in addition to these visibility challenges, may present further difficulties, including reduced visibility from post-surgical or post-RT edema and anatomical deformations caused by the tumor itself (Chen & Hudgins, 2013; Queija et al., 2020). Understanding these limitations is critical for improving the consistency and accuracy of residue assessment across raters.

6.2. Swallowing safety

Postural maneuvers had a significant effect on swallowing safety. According to Cohen's (1988) guidelines, the effect was large for IDDSI level 0 ($\eta^2 = .229$) and moderate ($\eta^2 = .120$) for IDDSI level 4.

The results suggest that the chin tuck improves swallowing safety relative to the neutral head position, whereas head extension reduces swallowing safety with IDDSI level 0. In pwHNC involving the hypopharyngeal subsite, chin tuck improved swallowing safety by reducing PAS scores, while head extension increased PAS scores relative to the neutral head position in pwHNC involving the laryngeal subsite.

Physiologically, chin-tuck brings the epiglottis closer to the posterior pharyngeal wall and approximates it to the laryngeal vestibule, narrowing the airway entrance and facilitating bolus containment in the oral cavity. This postural adjustment promotes earlier airway closure, optimizes hyoid and laryngeal elevation, and modulates the temporal sequence of swallowing events, reducing premature posterior spillage of thin liquids (Ayres, Silva, & Lima, 2017; Forbes, Young, & Macrae, 2021). Building upon these anatomical and physiological effects, it is important to note that thin liquids are more susceptible to flow rapidly to the pharynx and enter in the airway, suggesting that postural maneuvers such as the chin tuck may play a crucial role in reducing the likelihood of posterior spillage, improving short-term swallowing safety (Lee et al., 2023; Leigh et al., 2014; Oh et al., 2022; Park et al., 2021; Steele et al., 2015).

Conversely, head extension increases the volume of the oropharyngeal space, which accelerates bolus flow and compromises both oral and pharyngeal control (Lazarus et al., 1993; Logemann et al., 1994). This posture can particularly impair bolus containment with thin liquids (IDDSI level 0), increasing the likelihood of premature posterior spillage. Additionally, during head extension, reduced hyolaryngeal excursion, delayed laryngeal elevation, and airway closure further increase the risk of penetration and aspiration, facilitating inadvertent entry of the bolus into the airway (Steele & Cichero, 2014; Steele & Van Lieshout, 2005). This effect may be related to the fact that head extension stretches the

pharyngeal musculature, potentially limiting the ability to generate an effective pharyngeal contraction and airway protection (Ambiado-Lillo, 2025; Ertekin et al., 2001; Kelly et al., 2019; Barbon et al., 2020).

For IDDSI level 4, no significant differences were observed, suggesting that postural maneuvers did not have a significant effect on PAS scores in pwHNC with a thickened consistency, regardless of the HNC subsite.

The present findings also highlight the critical role of bolus viscosity in both swallowing safety and efficiency, in agreement with previous studies related to viscosities. Thicker boluses (IDDSI level 4) are generally easier to control and less susceptible to premature spillage, reducing penetration-aspiration risk (Lee et al., 2023; Steele & Cichero, 2014; Steele et al., 2015).

Regarding swallowing safety, Logemann et al. (1994) reported findings similar to those of the present study, demonstrating that the chin tuck may contribute to improved swallowing safety. Conversely, in this study, head extension showed limited effectiveness and may compromise swallowing safety, especially in pwHNC laryngeal subsite.

In terms of relative outcomes, the absence of significant effects for IDDSI level 4 bolus in the present study suggests that postural maneuvers may be more effective with thin liquids than with thicker consistencies, possibly due to physiological factors and rheological properties of the bolus.

6.3. Swallowing efficiency

Regarding swallowing efficiency, the analyses indicated increased vallecular and pyriform sinuses residue in head extension for IDDSI level 0. In pwHNC involving the laryngeal subsite, head extension was associated with increased pyriform sinuses residue compared to the neutral head position. Moreover, head rotation toward the affected side in pwHNC with left-sided involvement resulted in significantly greater vallecular residue for IDDSI level 0, indicating a reduction in pharyngeal clearance efficiency associated with this posture. No other postural maneuvers yielded statistically significant differences in swallowing efficiency at this consistency.

As previously mentioned regarding swallowing safety, this may be attributable to the fact that head extension stretches the pharyngeal musculature, potentially limiting the ability to generate an effective pharyngeal contraction (Ambiado-Lillo, 2025; Ertekin et al., 2001; Kelly et al., 2019; Barbon et al., 2020). Additionally, reduced pharyngolaryngeal sensitivity, tissue edema, and muscular fibrosis following RT may further impair bolus clearance, contributing to the higher residue observed (Chiu et al., 2022; Grover & Sinha, 2020; Langmore & Krisciunas, 2010).

On the other hand, thin liquids (IDDSI level 0) were associated with lower agreement, especially in the vallecula and pyriform sinuses, consistent with findings that liquids with lower viscosity are more prone to premature spillage and variable pharyngeal coating, which may complicate visual assessment during FEES (Steele & Cichero, 2014; Steele et al., 2015; Cichero et al., 2017).

At IDDSI level 4, head extension and head rotations to the unaffected and affected side significantly increased vallecular residue compared to neutral head position and chin tuck across pwHNC subsites. In pwHNC with laryngeal and oral cavity involvement, reduced laryngeal elevation and impaired airway closure, together with pharyngeal structural changes induced by head extension, may compromise pharyngeal clearance efficiency, resulting in increased vallecular residue (Ambiado-Lillo, 2025). Similarly, pyriform sinus residue was higher with head extension, particularly in the laryngeal subsite, when compared to the neutral head position.

These effects may reflect stretching of the pharyngeal musculature, post-RT muscular fibrosis, reduced pharyngolaryngeal sensitivity, and tissue edema, all of which can impair effective pharyngeal contraction and bolus clearance (Langmore & Krisciunas, 2010; Barbon et al., 2020; Chiu et al., 2022; Grover & Sinha, 2020). Moreover, thicker boluses (IDDSI level 4) require greater propulsive force and pharyngeal contraction than thinner liquids (IDDSI level 0), which may explain the higher residue scores observed with higher-viscosity consistencies (Steele & Van Lieshout, 2005; Steele et al., 2015).

Conversely, the reduction in vallecular residue observed with head extension in pwHNC involving the oral cavity subsite may reflect greater oral-phase swallowing difficulties, particularly impaired bolus propulsion. In this context, head extension may harness gravity increases the likelihood of the bolus moving toward the pyriform sinuses, thereby contributing to the decreased vallecular residue specifically observed in this subsite.

In addition to the aforementioned findings, the increased vallecular residue observed with the head rotation maneuvers to both the unaffected and affected side, compared with the neutral head position could also be explained by physiological changes in pharyngeal pressure patterns, associated with post-RT fibrosis, and reduced pharyngolaryngeal sensitivity, all of which impair effective bolus clearance (Ambiado-Lillo, 2025; Barbon et al., 2020; Chiu et al., 2022).

Kim et al. (2015) investigated the effects of head rotation and tilt on pharyngeal pressure events using high-resolution manometry (HRM), demonstrating that postural maneuvers significantly reduce maximum pressure in the lower pharynx and the pre-Upper Esophageal Sphincter (UES) region compared with the neutral head position. This reduction in pharyngeal and UES pressures may compromise bolus propulsion and pharyngeal clearance efficiency, resulting in higher post-swallow residue, thereby highlighting how head and neck posture can influence bolus propulsion and airway protection mechanisms.

Moreover, head rotation modifies the spatial configuration of the pharyngo-esophageal segment, potentially affecting the direction of bolus flow and the dynamics of UES opening. Although the maneuver is often used clinically to redirect the bolus away from the impaired side in unilateral pharyngeal weakness, in people without asymmetrical dysfunction or when different bolus consistencies are tested, this change in pressure and bolus trajectory may lead to less effective clearance and increased vallecular residue (Kim et al., 2015). These findings align with the biomechanical evidence that even in healthy individuals, head rotation not only modifies the direction of bolus progression but also affects pharyngeal clearance and UES dynamics (Kim et al., 2015).

Although this study was conducted in healthy individuals, applying similar methodologies to pwHNC would be clinically relevant, as oncologic interventions often disrupt the structural and neuromuscular integrity of the swallowing mechanism. High-resolution impedance manometry (HRM/HRIM) remains underutilized in pwHNC, yet its broader application is warranted, as it provides detailed insights into swallowing biomechanics and quantifies the magnitude and timing of pharyngeal pressures. This can support early detection of RT or surgery-induced complications and the evaluation of therapeutic swallowing strategies, and can help to quantify the degree and timing of pressures involved in swallowing disorders (Neijman et al., 2023).

Beyond physiological mechanisms, some methodological aspects may also have contributed to the present findings. Another hypothesis for the results related to head rotation is that the order of maneuver application may have, to some extent, influenced the outcomes, despite the methodological precautions taken. Specifically, since head rotation to the affected and unaffected sides was performed toward the end of the protocol.

Furthermore, for the analysis comparing the affected and unaffected sides, six participants were excluded, resulting in smaller and divided subsamples: left-sided HNC (n = 17) and right-sided HNC (n = 25). This reduction in sample size may have limited statistical power and increased variability. In addition, this subdivision introduced greater heterogeneity in terms of HNC subsites. The left-sided pwHNC group included more cases involving the oral cavity (n = 4), oropharynx (n = 5), and both laryngeal and hypopharyngeal subsites (n = 3 each), whereas the right-sided group presented a higher proportion of laryngeal cases (n = 11), followed by oral cavity (n = 5), oropharyngeal (n = 4), and hypopharyngeal (n = 3) involvement. This heterogeneity, particularly the predominance of laryngeal involvement on the right side, combined with the previously discussed RT-related factors and the altered bolus trajectory associated with head rotation, which can influence both pharyngeal clearance and UES dynamics, may partially account for the results observed.

6.4. Methodological strengths

Key methodological strengths of this study include the use of FEES, blinded assessment, standardized bolus volumes, consistencies, and administration protocols, as well as the employment of validated outcome measures. By addressing these critical methodological gaps, this study intends to provide reliable and clinically relevant evidence to guide the implementation of postural maneuvers in pwHNC.

To the best of our knowledge, this study includes one of the largest cohorts to date assessing the effects of postural maneuvers in pwHNC.

6.5. Limitations

Despite some methodological strengths, several limitations should be considered when interpreting the findings of this study. The absence of audio recording during FEES limited the ability to fully assess participants' responses to laryngeal penetration and aspiration. Whitish secretions following RT may have complicated the analysis, particularly for thin liquids (IDDSI level 0) colored white. Anatomical deformations of structures such as the epiglottis and arytenoids, resulting from the tumor or adjuvant interventions (e.g., CRT or RT) in some participants, hindered airway visualization. Post-RT participants often exhibited a reduced range of motion due to edema and muscular fibrosis, potentially limiting the full execution of postural maneuvers. Such reduced mobility may prevent pwHNC from achieving the precise head or neck positions required for proper execution of postural maneuvers. Participants with NGT may have influenced participants' PAS and YPRSRS scores due to the presence of the tube.

The timing of oncological treatment may have influenced swallowing performance, as acute and late treatment effects can differentially impact swallowing function. Participants had not received speech and language therapy intervention and had only undergone a prior instrumental assessment for diagnostic purposes, limiting the generalizability of the findings to pwHNC undergoing active rehabilitation. Moreover, the fixed order of maneuver presentation may have introduced bias, as later maneuvers (e.g., head rotation)

could have been influenced by participant fatigue despite rest periods, as well as by residual bolus from previous trials.

Additional limitations include the heterogeneous convenience-based sample, as well as the small size and heterogeneity of the subsamples used in the subsite-specific analyses of HNC, which may limit the generalizability of the results. The study employed a short sampling window and did not capture daily variability, patient burden, or typical eating behavior.

Only two IDDSI consistencies were evaluated, and assessments were limited to small volumes. The cross-sectional design assessed only the immediate effects of postural maneuvers, precluding conclusions regarding long-term utilization, such as participants' daily routines. Although procedures were standardized and external raters were blinded, the results showed some variability, with agreement levels remaining within the moderate range. Finally, the study was conducted at a single clinical center, potentially limiting external validity to other settings.

These limitations highlight the need for cautious interpretation of the results and suggest that further research with larger, more diverse samples, longitudinal follow-up, and multimodal assessment is warranted to fully understand the effect of postural maneuvers on swallowing safety and efficiency in pwHNC.

6.6. Considerations for future research

It is important to highlight that the population of pwHNC is highly heterogeneous, varying in HNC location, subsite, staging, and type of intervention. Therefore, future studies should include a much larger and more diverse sample to increase the generalizability of the findings. Furthermore, it is essential to emphasize the need for individualized assessment and tailored approaches based on the HNC subsite.

In the present study, the focus was on the pharyngeal phase of swallowing, which is why FEES was used to measure the primary outcomes. However, future investigations would benefit from evaluating additional parameters such as swallow reaction time, premature posterior spillage, and white-out, to provide a

deeper understanding of the underlying mechanisms of swallowing and the factors contributing to pharyngeal residue and penetration-aspiration events.

Assessing the oral phase of swallowing and oral cavity residues using a visual analog scale, as well as monitoring nasal regurgitation and nasal cavity residues in pwHNC involving the nasopharynx and oropharynx subsites, would also provide valuable insights into the interdependence of the oral and pharyngeal phases. Evaluating oral-phase control, including bolus management, lip closure to prevent anterior escape, coordination of the tongue movements and strength, and effectiveness of the soft palate sphincter in preventing nasal regurgitation, clarifies the roles of these structures in effective bolus propulsion and overall swallowing, thereby enhancing the understanding and management of swallowing disorders.

Given the challenges experienced by some participants due to structural anatomical anomalies that hindered outcome scoring, complementary assessment using a VFSS could be useful. VFSS allows dynamic visualization of the oral phase, including bolus control, quantification of oral transit time, assessment of tongue-palate coordination, and detection of anterior or lateral bolus escape as well as premature posterior bolus spillage. It also enables measurement of swallowing reaction time and evaluation of the interdependence between oral and pharyngeal phases. Incorporating VFSS alongside FEES, therefore, enhances the comprehensiveness and precision of swallowing assessment, providing a more complete understanding of the mechanisms underlying swallowing disorders in pwHNC.

Future research should use HRIM to assess pharyngeal pressure events across postural maneuvers, enhancing our understanding of these compensatory strategies.

It would also be important to evaluate the safety and efficacy of swallowing following the implementation of postural maneuvers with different volumes (e.g., 10, 15, 20 mL) and consistencies, including both liquids and solids, to explore rheological factors.

Future studies could follow the IDDSI framework to test liquids and foods across different thickness levels. This approach would allow for a more comprehensive assessment of swallowing safety and efficiency across a range of consistencies and textures.

In pwHNC who have undergone total laryngectomy, swallowing safety is not applicable due to the absence of the laryngeal airway. However, swallowing efficiency can still be assessed. The YPRSRS was used in this study, as it is the only instrument validated for European Portuguese. Nevertheless, this scale does not account for the anatomical specificities of total laryngectomy patients (e.g., absence of the larynx, valleculae, and piriform sinuses). Accordingly, the DIGEST-FEES protocol may offer a more suitable and comprehensive approach for evaluating swallowing function in this population.

7. Conclusion

Postural maneuvers are widely used in the management of swallowing disorders, yet despite being considered a classic intervention, their mechanisms and effects continue to warrant further investigation. This study is particularly relevant as it revisits this topic from a novel perspective, providing updated insights into the physiological effects of head and neck posture on swallowing safety and efficiency in pwHNC.

The biomechanical effects of postural maneuvers observed in this study underscore the importance of tailoring compensatory strategies to the individual needs of pwHNC. The chin tuck maneuver appeared potentially beneficial and should be included among the postures evaluated during clinical swallowing assessment in this population, likely by enhancing bolus control and reducing penetration and aspiration. Conversely, head extension and head rotation should be applied with caution, as they may compromise overall swallowing safety and efficiency, increasing the risk of penetration–aspiration events and pharyngeal residue.

These findings emphasize the importance of tailoring postural adjustments to each patient’s specific physiological profile, as individualized strategies may

promote short-term improvements in swallowing function, facilitate the initiation of oral intake, and minimize airway compromise.

These results also underscore the importance of taking both bolus viscosity and anatomical subsite into consideration when implementing postural maneuvers. Thicker consistencies may enhance swallowing safety, whereas thin liquids require careful evaluation and, in some cases, additional compensatory strategies. Tailoring the combination of bolus viscosity and postural maneuver according to the tumor’s primary anatomical subsite may therefore optimize swallowing functionality in pwHNC.

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9. Supplementary Table S1

Supplementary Table S1. *PAS and YPRSRS scores for vallecular and pyriform sinus residue across all HNC subsites for both IDDSI levels.*

Postural maneuvers	*Mean ± SD*	*t (Sidak)*	*MD [95% CI]*	*p-value*
PAS with IDDSI level 0				
Larynx				
Neutral	4.50 ± 1.91	---	---	---
Chin tuck	4.47 ± 1.87	.261	.031 [-.738, .801]	1.000
Head extension	5.63 ± 1.18	.282	-1.125 [-1.958, -.292]	.003*
Head rotation to R	4.94 ± 1.65	.290	-.437 [-1.294, .419]	.775
Head rotation to L	5.13 ± 1.41	.334	-.625 [-1.613, .363]	.509
Oral cavity				
Neutral	3.32 ± 1.93	---	---	---
Chin tuck	2.86 ± 2.05	.314	.455 [-.474, 1.383]	.815
Head extension	4.09 ± 2.30	.340	-.773 [-1.777, .231]	.248
Head rotation to R	3.64 ± 2.20	.350	-.318 [-1.351, .715]	.990
Head rotation to L	3.41 ± 2.54	.403	-.091 [-1.283, 1.101]	1.000
Oropharynx				
Neutral	4.25 ± 2.49	---	---	---
Chin tuck	3.60 ± 2.47	.330	.650 [-.324, 1.624]	.433
Head extension	4.45 ± 2.19	.356	-.200 [-1.253, .853]	1.000
Head rotation to R	4.40 ± 2.20	.367	-.150 [-1.233, .933]	1.000
Head rotation to L	4.35 ± 2.37	.423	-.100 [-1.350, 1.150]	1.000
Hypopharynx				
Neutral	4.83 ± 1.21	---	---	---
Chin tuck	3.50 ± 2.05	.425	1.333 [.076, 2.590]	.031*
Head extension	5.17 ± 1.37	.460	-.333 [-1.693, 1.026]	.998
Head rotation to R	4.92 ± 1.72	.473	-.083 [-1.482, 1.315]	1.000
Head rotation to L	4.67 ± 1.75	.546	.167 [-1.477, 1.780]	1.000
Nasopharynx				
Neutral	5.33 ± 2.57	---	---	---
Chin tuck	5.17 ± 2.36	.602	.167 [-1.611, 1.944]	1.000
Head extension	5.33 ± 2.57	.651	.000 [-1.923, 1.923]	1.000
Head rotation to R	5.17 ± 2.84	.669	.167 [-1.811, 2.145]	1.000
Head rotation to L	5.00 ± 3.12	.772	.333 [-1.949, 2.615]	1.000
Unknown				
Neutral	3.25 ± 1.06	---	---	---
Chin tuck	2.50 ± 0.71	.737	.750 [-1.427, 2.927]	.977
Head extension	3.75 ± 0.35	.797	-.500 [-2.855, 1.855]	1.000
Head rotation to R	3.25 ± 0.35	.820	.000 [-2.422, 2.422]	1.000
Head rotation to L	3.50 ± 2.12	.946	-.250 [-3.045, 2.545]	1.000
PAS with IDDSI level 4				
Larynx				
Neutral	1.94 ± 1.52	---	---	---

Chin tuck	1.53 ± 0.76	.208	.406 [-.207, 1.020]	.444
Head extension	2.19 ± 1.29	.241	-.250 [-.963, .463]	.974
Head rotation to R	2.03 ± 1.26	.204	-.094 [-.695, .508]	1.000
Head rotation to L	1.94 ± 1.15	.238	.000 [-.702, .702]	1.000
Oral cavity				
Neutral	1.27 ± 0.52	---	---	----
Chin tuck	1.09 ± 0.30	.250	.182 [-.558, .922]	.998
Head extension	1.50 ± 0.77	.291	-.227 [-1.087, .632]	.997
Head rotation to R	1.27 ± 0.61	.245	.000 [-.725, .725]	1.000
Head rotation to L	1.41 ± 0.80	.287	-.136 [-.983, .711]	1.000
Oropharynx				
Neutral	2.55 ± 2.35	---	---	---
Chin tuck	2.35 ± 2.23	.263	.200 [-.576, .976]	.997
Head extension	2.75 ± 2.59	.305	-.200 [-1.102, .702]	.999
Head rotation to R	2.60 ± 2.31	.257	-.050 [-.811, .711]	1,000
Head rotation to L	2.75 ± 2.40	.301	-.200 [-1.088, .688]	.999
Hypopharynx				
Neutral	2.08 ± 1.86	---	---	---
Chin tuck	1.75 ± 1.41	.339	.333 [-.668, 1.335]	.982
Head extension	2.25 ± 1.78	.394	-.167 [-1.331, .997]	1.000
Head rotation to R	2.08 ± 1.86	.332	.000 [-.982, .982]	1.000
Head rotation to L	2.25 ± 1.78	.388	-.167 [-1.314, .980]	1.000
Nasopharynx				
Neutral	3.67 ± 2.52	---	---	---
Chin tuck	3.33 ± 2.52	.480	.333 [-1.083, 1.750]	.999
Head extension	3.67 ± 2.52	.557	.000 [-1.646, 1.646]	1.000
Head rotation to R	3.67 ± 2.52	.470	.000 [-1.389, 1.389]	1.000
Head rotation to L	3.67 ± 2.52	.549	.000 [-1.622, 1.622]	1.000
Unknown				
Neutral	1.50 ± 0.71	---	---	---
Chin tuck	1.25 ± 0.35	.587	.250 [-1.485, 1.985]	1.000
Head extension	2.00 ± 1.41	.682	-.500 [-2.516, 1.516]	.998
Head rotation to R	1.00 ± 0.00	.576	.500 [-1.201, 2.201]	.993
Head rotation to L	1.50 ± 0.71	.672	.000 [-1.987, 1.987]	1.000
YPRSRS for vallecular residue with IDDSI level 0				
Larynx				
Neutral	2.19 ± 0.63	---	---	---
Chin tuck	2.31 ± 0.40	.100	-.125 [-.422, .172]	.916
Head extension	2.38 ± 0.43	.098	-.188 [-.478, .103]	.483
Head rotation to R	2.31 ± 0.51	.084	-.125 [-.374, .124]	.791
Head rotation to L	2.41 ± 0.46	.108	-.219 [-.539, .102]	.402
Oral cavity				
Neutral	2.27 ± 0.41	---	---	---
Chin tuck	2.31 ± 0.40	.121	-.045 [-.403, .312]	1.000

Head extension	2.50 ± 0.45	.119	-.227 [-.587, .124]	.476
Head rotation to R	2.36 ± 0.39	.101	-.091 [-.391, .209]	.991
Head rotation to L	2.41 ± 0.44	.131	-.136 [-.523, .250]	.973
Oropharynx				
Neutral	2.55 ± 0.86	---	---	---
Chin tuck	2.55 ± 0.76	.127	.000 [-.375, .375]	1.000
Head extension	2.70 ± 0.92	.125	-.150 [-.518, .218]	.932
Head rotation to R	2.60 ± 0.88	.106	-.050 [-.364, .264]	1.000
Head rotation to L	2.55 ± 0.64	.137	.000 [-.405, .405]	1.000
Hypopharynx				
Neutral	2.25 ± 0.61	---	---	---
Chin tuck	2.25 ± 0.69	.164	.000 [-.484, .484]	1.000
Head extension	2.33 ± 0.61	.161	-.083 [-.559, .392]	1.000
Head rotation to R	2.33 ± 0.61	.137	-.083 [-.489, .323]	1.000
Head rotation to L	2.33 ± 0.61	.177	-.083 [-.607, .440]	1.000
Nasopharynx				
Neutral	2.00 ± 0.50	---	---	---
Chin tuck	2.33 ± 0.58	.232	-.333 [-1.018, .351]	.820
Head extension	2.33 ± 0.58	.227	-.333 [-1.005, .339]	.804
Head rotation to R	2.17 ± 0.76	.194	-.167 [-.741, .408]	.994
Head rotation to L	2.33 ± 0.58	.250	-.333 [-1.073, .407]	.879
Unknown				
Neutral	2.00 ± 0.00	---	---	---
Chin tuck	2.25 ± 0.35	.284	-.250 [-1.089, .589]	.992
Head extension	2.50 ± 0.00	.279	-.500 [-1.323, .323]	.565
Head rotation to R	2.50 ± 0.00	.238	-.500 [-1.203,.203]	.347
Head rotation to L	2.50 ± 0.00	.307	-.500 [-1.406, .406]	.690
YPRSRS for pyriform sinuses residue with IDDSI level 0				
Larynx				
Neutral	1.97 ± 0.81	---	---	---
Chin tuck	2.00 ± 0.71	.140	-.031 [-.444, .382]	1.000
Head extension	2.41 ± 0.71	.133	-.437 [-.831, -.044]	.021*
Head rotation to R	2.31 ± 0.73	.126	-.344 [-.716, .028]	.089
Head rotation to L	2.28 ± 0.66	.155	-.313 [.770, .145]	.401
Oral cavity				
Neutral	2.14 ± 0.87	---	---	---
Chin tuck	1.95 ± 0.72	.169	.182 [-.317, .680]	.966
Head extension	2.05 ± 0.65	.161	.091 [-.384, .566]	1.000
Head rotation to R	2.05 ± 0.72	.152	.091 [-.358, .540]	1.000
Head rotation to L	2.18 ± 0.68	.187	-.045 [-.597, .506]	1.000
Oropharynx				
Neutral	2.40 ± 0.99	---	---	---
Chin tuck	2.30 ± 0.98	.177	.100 [-.423, .623]	1.000
Head extension	2.35 ± 0.94	.169	.050 [-.448, .548]	1.000

Head rotation to R	2.30 ± 0.82	.159	.100 [-.371, .571]	1.000
Head rotation to L	2.35 ± 0.75	.196	.050 [-.528, .628]	1.000
Hypopharynx				
Neutral	1.75 ± 0.99	---	---	---
Chin tuck	1.83 ± 0.68	.228	-.083 [-.758, .591]	1.000
Head extension	2.33 ± 0.75	.218	-.583 [-1.227, .060]	.100
Head rotation to R	2.08 ± 0.80	.206	-.333 [-.941, .275]	.698
Head rotation to L	2.17 ± 0.75	.253	-.417 [-1.163, .330]	.676
Nasopharynx				
Neutral	2.33 ± 1.26	---	---	---
Chin tuck	2.50 ± 1.00	.323	-.167 [-1.121, .788]	1.000
Head extension	2.50 ± 1.00	.308	-.167 [-1.076, .743]	1.000
Head rotation to R	2.50 ± 1.00	.291	-.167 [-1.026, .693]	1.000
Head rotation to L	2.33 ± 1.29	.357	.000 [-1.056, 1.056]	1.000
Unknown				
Neutral	2.25 ± 0.35	---	---	---
Chin tuck	2.25 ± 0.35	.396	.000 [-1.169, 1.169]	1.000
Head extension	2.75 ± 0.35	.377	-.500 [-1.614, .614]	.881
Head rotation to R	2.25 ± 0.35	.356	.000 [-1.053, 1.053]	1.000
Head rotation to L	2.25 ± 0.35	.438	.000 [-1.293, 1.293]	1.000
YPRSRS for vallecular residue with IDDSI level 4				
Larynx				
Neutral	2.44 ± 0.96	---	---	---
Chin tuck	2.50 ± 1.10	.146	-.063 [-.493, .368]	1.000
Head extension	3.06 ± 1.10	.174	-.625 [-1.140, -.110]	.009*
Head rotation to R	2.81 ± 1.01	.200	-.375 [-.965, .215]	.502
Head rotation to L	2.88 ± 1.02	.193	-.438 [-1.009, .134]	.254
Oral cavity				
Neutral	2.41 ± 0.44	---	---	---
Chin tuck	2.45 ± 0.35	.176	-.045 [-.565, .474]	1.000
Head extension	3.05 ± 0.72	.210	-.636 [-1.257, -.016]	.041*
Head rotation to R	2.82 ± 0.78	.241	-.409 [-1.120, .302]	.638
Head rotation to L	2.86 ± 0.92	.233	-.455 [-1.144, .235]	.450
Oropharynx				
Neutral	2.95 ± 1.19	---	---	---
Chin tuck	2.85 ± 1.16	.184	.100 [-.445, .645]	1.000
Head extension	3.25 ± 1.30	.220	-.300 [-.951, .351]	.864
Head rotation to R	3.20 ± 1.21	.253	-.250 [-.966, .496]	.981
Head rotation to L	3.15 ± 1.25	.245	-.200 [-.923, .523]	.996
Hypopharynx				
Neutral	2.25 ± 0.82	---	---	---
Chin tuck	2.17 ± 0.75	.238	.083 [-.620, .786]	1.000
Head extension	2.33 ± 0.41	.284	-.083 [-.924, .757]	1.000
Head rotation to R	2.33 ± 0.41	.326	-.083 [-1.047, .880]	1.000

Head rotation to L	2.17 ± 0.68	.316	.083 [-.850, 1.016]	1.000
Nasopharynx				
Neutral	2.50 ± 1.50	---	---	---
Chin tuck	2.50 ± 1.50	.337	.000 [-.994, .994]	1.000
Head extension	2.83 ± 0.76	.402	-.333 [-1.522, .855]	.995
Head rotation to R	2.83 ± 0.76	.461	-.333 [-1.695, 1.029]	.998
Head rotation to L	2.83 ± 0.76	.447	-.333 [-1.653, .986]	.998
Unknown				
Neutral	2.25 ± 0.35	---	---	---
Chin tuck	2.25 ± 0.35	.412	.000 [-1.218, 1.218]	1.000
Head extension	3.00 ± 0.00	.493	-.750 [-2.206, .706]	.767
Head rotation to R	3.00 ± 0.71	.565	-.750 [-2.418, .918]	.880
Head rotation to L	3.25 ± 1.06	.547	-1.000 [-2.616, .616]	.540
YPRSRS for pyriform sinuses residue with IDDSI level 4				
Larynx				
Neutral	1.83 ± 0.06	---	---	---
Chin tuck	1.97 ± 1.19	.157	-.156 [-.621, .309]	.981
Head extension	2.38 ± 1.25	.186	-.562 [-1.112, -.013]	.042*
Head rotation to R	2.22 ± 1.18	.160	-.406 [-.879, .066]	.139
Head rotation to L	2.25 ± 1.28	.170	-.438 [-.939, .064]	.127
Oral cavity				
Neutral	1.82 ± 0.51	---	---	---
Chin tuck	1.55 ± 0.57	.190	.273 [-.288, .833]	.821
Head extension	2.36 ± 1.19	.224	-.545 [-1.208, .118]	.178
Head rotation to R	1.68 ± 0.72	.193	.136 [-.433, .706]	.999
Head rotation to L	1.86 ± 0.74	.205	-.045 [-.605, .559]	1.000
Oropharynx				
Neutral	1.80 ± 1.06	---	---	---
Chin tuck	1.60 ± 0.70	.199	.200 [-.388, .788]	.979
Head extension	2.10 ± 1.31	.235	-.300 [-.995, .395]	.905
Head rotation to R	1.95 ± 1.28	.202	-.150 [-.748, .448]	.998
Head rotation to L	1.90 ± 1.31	.215	-.100 [-.734, .534]	1.000
Hypopharynx				
Neutral	1.67 ± 0.88	---	---	---
Chin tuck	1.58 ± 0.74	.257	.083 [-.676, .843]	1.000
Head extension	1.75 ± 0.88	.304	-.083 [-.981, .814]	1.000
Head rotation to R	1.50 ± 0.84	.261	.167 [-.605, .938]	.999
Head rotation to L	1.67 ± 0.82	.277	.000 [-.819, 819]	1.000
Nasopharynx				
Neutral	2.33 ± 1.26	---	---	---
Chin tuck	2.50 ± 1.00	.363	-.167 [-1.240, .907]	1.000
Head extension	2.67 ± 0.76	.430	-.333 [-1.603, .936]	.997
Head rotation to R	2.67 ± 0.76	.369	-.333 [-1.424, .758]	.990
Head rotation to L	2.50 ± 1.00	.392	-.167 [-1.325, .991]	1.000

Unknown				
Neutral	1.75 ± 0.35	---	---	---
Chin tuck	1.50 ± 0.71	.445	.250 [-1.065, 1.565]	1.000
Head extension	2.00 ± 0.71	.526	-.250 [-1.805, 1.305]	1.000
Head rotation to R	2.25 ± 0.35	.452	-.500 [-1.836, .836]	.960
Head rotation to L	2.00 ± 0.71	.480	-.250 [-1.668, 1.168]	1.000

CI = Confidence Interval; SD = Standard Deviation; MD = Mean Diference; IDDSI = International Dysphagia Diet Standardisation Initiative; PAS = Penetration-Aspiration Scale; YPRSRS = Yale Pharyngeal Residue Severity Rating Scale; R = Right side; L = Left side. Note: small differences in the mean differences (e.g., < E-10) have been rounded to zero.

10. Appendix

Appendix A: Consentimento informado escrito

UNIDADE LOCAL DE SAÚDE
LISBOA OCIDENTAL

CONSENTIMENTO INFORMADO RELATIVO AO ESTUDO "O EFEITO DAS MANOBRAS POSTURAIS NA SEGURANÇA E EFICÁCIA DA DEGLUTIÇÃO EM PESSOAS COM CANCRO DE CABEÇA E PESCOÇO".

Por favor, leia com atenção a seguinte informação. Se considerar que algum dado está incorreto ou não está claro, não hesite em solicitar mais informações até ver todas as suas dúvidas esclarecidas. Se concorda com a proposta que lhe foi feita, assine este documento no espaço dedicado para o efeito.

TÍTULO DO ESTUDO: O efeito das manobras posturais na segurança e eficácia da deglutição em pessoas com cancro de cabeça e pescoço.

TIPO DE ESTUDO: Estudo observacional analítico de carácter transversal.

Excelentíssimo(a) Sr(a).,

Eu, Gonçalo Calçada Bernardes (cédula profissional n.º C-073471178), no âmbito da elaboração da minha tese de mestrado em terapia da fala do Instituto Politécnico de Setúbal, sob a orientação dos docentes: Célia Soares e David Nascimento, venho por este meio convidá-lo(a) a participar num estudo que estou a desenvolver.

Este documento pretende fornecer informações quanto aos objetivos, procedimentos, benefícios e riscos do estudo. Assim, recomenda-se que leia atentamente este documento, para que consiga, posteriormente, tomar uma decisão informada relativamente à sua participação no estudo.

Qual o objetivo do estudo?

Avaliar o efeito de realizar mudanças na postura da cabeça e pescoço, na deglutição (ato de engolir) em pessoas com dificuldades em engolir devido a um cancro.

Porque fui selecionado(a) para participar neste estudo?

Foi selecionado uma vez que apresenta possivelmente dificuldades em engolir devido a um cancro de cabeça e pescoço.

O que lhe será pedido se aceitar participar no estudo?

Ser-lhe-á pedido para realizar um exame chamado videoendoscopia da deglutição (VED) que irá decorrer no serviço de otorrinolaringologia da Unidade Local de Saúde Lisboa Ocidental. Durante a realização do exame estará acompanhado por um(a) médico(a) otorrinolaringologista e por um terapeuta da fala. Este método é de fácil realização e não existe exposição à radiação.

A VED consiste na colocação de um tubo fino e flexível pelo nariz e que progride até à garganta. Este procedimento será realizado por um(a) médico(a) otorrinolaringologista, assistido por um terapeuta da fala. Durante o exame serão oferecidos líquidos com diferentes texturas, corados com corante alimentar branco e verde, para facilitar a visualização dos mesmos. Durante o exame o terapeuta da fala solicitar-lhe-á que realize mudanças na postura da cabeça e pescoço (e.g., baixar a cabeça, levantar a cabeça e rodar a cabeça), com o objetivo de avaliar a sua deglutição.

Mais acrescento que, para participar no estudo, deverá concordar com a gravação audiovisual do exame e recolha fotográfica da sua boca, para que possa ser analisada posteriormente.

Qual é o tempo de duração da minha participação no estudo?

A sua participação no estudo terá a duração aproximada de 25 minutos.

Quais os potenciais riscos associados à participação no estudo?

Apesar de raras, a VED pode causar reações adversas, tais como:

- Dor e/ou desconforto;
- O corante alimentar utilizado contém vestígios de leite, soja, trigo, frutos secos e marisco, pelo que poderá causar reações alérgicas a pessoas intolerantes;
- Possível reação adversa ao anestésico (caso seja utilizado na VED);
- Risco de aspiração (passagem de líquido para a via aérea, caso ocorra, serão pequenas quantidades e a sua segurança será assegurada);
- Laringospasmo (breve encerramento da via aérea durante a VED);
- Sensação de desmaio e/ou vómito (resposta vagal);
- Sangramento nasal.

Apesar dos potenciais riscos, salienta-se que a VED realizar-se-á em contexto hospitalar na presença de um médico otorrinolaringologista e de um terapeuta da fala e, em caso de eventuais episódios de aspiração, serão utilizadas algumas mudanças na postura da sua cabeça e pescoço para melhorar a segurança da sua deglutição. Previamente ao exame, será

questionado(a) quanto à presença de intolerâncias alimentares. Caso apresente intolerância a algum dos componentes do corante alimentar, a VED não será realizada.

Quais os potencias benefícios associados à participação no estudo?

Contribuir para um aumento no conhecimento sobre:

- A manobra postural adequada para melhorar a sua deglutição;
- Qual o tipo de alimentação que deve ingerir;
- A possibilidade de ingerir novos alimentos de forma segura e eficaz;
- A implementação de mudanças na postura da cabeça e pescoço de forma eficaz, prevenindo que exista passagem de líquido e/ou alimento para o pulmão e, consequentemente, prevenir infeções respiratórias (pneumonias);
- Estratégias para maximizar a funcionalidade da sua deglutição;
- Estratégias para promover o prazer alimentar;
- Estratégias para otimizar a sua qualidade de vida.

O que é que acontece se desistir?

Informa-se que, como participante no estudo, poderá desistir do estudo a qualquer momento, sem risco de sofrer consequências.

Existe algum custo para a participação no estudo?

Não, não há custos diretos para participar no estudo. Porém, para participar deverá deslocar-se até ao serviço de otorrinolaringologia da Unidade Local de Saúde Lisboa Ocidental. Os possíveis custos de deslocação ficarão ao seu encargo.

Como serão utilizados os dados recolhidos?

Todos os dados recolhidos ao longo do estudo são confidenciais, mantendo o anonimato do participante. Os dados recolhidos serão armazenados de uma forma segura, encontrando-se alocados a uma base de dados de uma instituição, protegida por palavra-passe, por um período mínimo de dois anos, desde a conclusão do estudo, ou em caso de publicação científica, até à sua data de publicação, não sendo utilizados para outros fins.

Quem devo de contactar em caso de dúvida?

Em caso de dúvida deve contactar o investigador responsável pelo desenvolvimento do estudo, Gonçalo Calçada Bernardes, através do seguinte endereço eletrónico: goncalo.bernardes@estudantes.ess.ips.pt ou através do seguinte contacto telefónico: (+351) 930 576 488. Em caso de contactar o investigador principal e não ficar esclarecido, pode ainda

entrar em contacto com o Encarregado de Proteção de Dados da ULSLO através do seguinte endereço eletrónico: dpo@ulslo.min-saude.pt

Nome: _____ | Assinatura: _____

Número da cédula da ordem profissional: _____

Data (dia/mês/ano): _____

Participante:

DECLARO ter lido e compreendido este documento bem como as informações que me foram prestadas. Foi-me garantida a possibilidade de, em qualquer altura, recusar participar neste estudo sem quaisquer prejuízos. Desta forma, aceito participar de forma voluntária e permito a utilização dos dados colhidos confiando que apenas serão utilizados para esta investigação e nas garantias de confidencialidade e anonimato que me são dadas pelo investigador.

_____ (local), ____/____/_____ (data)

Nome: |_____|

Assinatura _____

SE NÃO FOR O PRÓPRIO A ASSINAR POR IDADE OU INCAPACIDADE
(se o menor tiver discernimento deve também assinar em cima)

NOME: _____
DOC. IDENTIFICAÇÃO N.º ..... DATA OU VALIDADE ____/____/_____
GRAU DE PARENTESCO OU TIPO DE REPRESENTAÇÃO:_____
ASSINATURA _____

Nota: Este documento é feito em duas vias originais – uma para o processo e outra para ficar na posse de quem consente

Appendix B: Carta convite aos avaliadores externos (ENT-FC e ENT-SC)

UNIDADE LOCAL DE SAÚDE
LISBOA OCIDENTAL

CONSENTIMENTO INFORMADO RELATIVO AO ESTUDO "O EFEITO DAS MANOBRAS POSTURAIS NA SEGURANÇA E EFICÁCIA DA DEGLUTIÇÃO EM PESSOAS COM CANCRO DE CABEÇA E PESCOÇO".

Por favor, leia com atenção a seguinte informação. Se considerar que algum dado está incorreto ou não está claro, não hesite em solicitar mais informações até ver todas as suas dúvidas esclarecidas. Se concorda com a proposta que lhe foi feita, assine este documento no espaço dedicado para o efeito.

TÍTULO DO ESTUDO: O efeito das manobras posturais na segurança e eficácia da deglutição em pessoas com cancro de cabeça e pescoço.

TIPO DE ESTUDO: Estudo observacional analítico de carácter transversal.

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Este documento pretende fornecer informações quanto aos objetivos, procedimentos, benefícios e riscos do estudo. Assim, recomenda-se que leia atentamente este documento, para que consiga, posteriormente, tomar uma decisão informada relativamente à sua participação no estudo.

Qual o objetivo do estudo?

Com este estudo pretende-se verificar o efeito da utilização de manobras compensatórias na funcionalidade da deglutição em pessoas com perturbações da deglutição proveniente de cancro de cabeça e pescoço (CCP).

Porque fui selecionado(a) para participar no estudo?

Foi selecionado(a) para participar no estudo por apresentar um perfil que se enquadra com os critérios de inclusão do presente estudo:

- Ser terapeuta da fala ou médico otorrinolaringologista;
- Experiência clínica superior a cinco anos na área da deglutição;
- Formação específica na área da deglutição;
- Experiência clínica superior a cinco anos na área do cancro de cabeça e pescoço.

O que lhe será pedido se aceitar participar no estudo?

Ser-lhe-á solicitado que visualize as gravações de vídeo das videoendoscopias da deglutição (VED) realizadas aos participantes presentes no estudo, no serviço de otorrinolaringologia da Unidade Local de Saúde Lisboa Ocidental. Ser-lhe-á também solicitado o preenchimento à posteriori, da *Penetration-Aspiration Scale* (PAS) e *Yale Pharyngeal Residue Severity Rating Scale* (YPRSRS), bem como *Murray-Secretion Scale* (MSS), tempo de reação à deglutição (TRD), escape posterior prematuro (i.e., *premature bolus spillage*) e da escala visual de acumulação de resíduos na cavidade oral (EVARCO) de acordo com os dados observados na VED.

Qual é o tempo de duração da minha participação no estudo?

A sua participação no estudo terá a duração da realização da videoendoscopia da deglutição e preenchimento da PAS e YPRSRS, bem como MSS, TRD, escape posterior prematuro e EVARCO, sendo esta aproximadamente vinte e cinco minutos por participante.

Tendo em conta que se espera uma amostra mínima de vinte e um participantes, estima-se que a duração total da sua participação será de aproximadamente dez horas.

Quais os riscos associados à participação no estudo?

Não há riscos esperados ao participar neste estudo.

Quais os benefícios associados à participação no estudo?

Não existe um benefício direto quanto à sua participação no estudo, contudo, poderá:

- Contribuir para o desenvolvimento de um estudo experimental, no âmbito de uma temática com carência de evidência científica;
- Aumentar o conhecimento relativamente à biodinâmica da deglutição em pessoas com NPC, compreendendo quais a(s) manobra(s) posturais mais eficazes na melhoria da segurança e eficácia da deglutição nesta população.

O que é que acontece se desistir?

Informa-se que, como avaliador externo do estudo, terá o direito de desistir do mesmo a qualquer momento, sem sofrer nenhuma penalização.

Existe algum custo para a participação no estudo?

Para participar no estudo deverá descolar-se até ao serviço de otorrinolaringologia da Unidade Local de Saúde Lisboa Ocidental. Os possíveis custos de deslocação ficarão ao seu encargo.

Como serão utilizados os dados recolhidos?

Todos os dados recolhidos ao longo do estudo são confidenciais, mantendo o anonimato do participante. Os dados recolhidos serão armazenados de uma forma segura, encontrando-se alocados a uma base de dados de uma instituição, protegida por palavra-passe, por um período mínimo de dois anos, desde a conclusão do estudo, ou em caso de publicação científica, até à sua data de publicação, não sendo utilizados para outros fins.

Quem devo contactar em caso de dúvida?

Em caso de dúvida deve contactar o investigador responsável pelo estudo através do seguinte endereço eletrónico: goncalo.bernardes@estudantes.ess.ips.pt ou através do seguinte contacto telefónico: (+351) 930576488. Em caso de contactar o investigador principal e não ficar esclarecido, pode ainda entrar em contacto com o Encarregado de Proteção de Dados da ULSLO através do seguinte endereço eletrónico: dpo@ulslo.min-saude.pt

FORMULÁRIO DE CONSENTIMENTO INFORMADO

Eu, abaixo-assinado, declaro que li atentamente os conteúdos descritos na folha de informação ao avaliador externo, compreendendo que, para participar no estudo terei de realizar uma videoendoscopia da deglutição (VED) aos participantes presentes no estudo e, preencher posteriormente a PAS e YPRSRS, bem como MSS, TRD, escape posterior prematuro e EVARCO, de acordo com os dados observado na VED.

Declaro que, tomei conhecimento que os meus dados serão de carácter confidencial e que é garantida a proteção da minha identificação e a confidencialidade dos meus dados.

Compreendi que não existe qualquer tipo de compensação pela participação no estudo e fui informado dos riscos, benefícios e custos associados ao mesmo, sendo a minha participação de carácter voluntário, tendo o direito de desistir a qualquer momento, sem sofrer qualquer tipo de penalização.

Tive a oportunidade de esclarecer as minhas dúvidas e fui informado que poderei colocá-las em qualquer momento. Mais declaro que, recebi uma cópia assinada deste documento.

Assinatura do avaliador externo: _____.

Eu, como investigador responsável, declaro que informei o avaliador externo quanto ao objetivo do estudo, bem como aos potenciais riscos, benefícios, custos e procedimentos associados ao mesmo. Mais acrescento que, demostrei-me disponível para responder às dúvidas colocadas e que forneci uma cópia do presente documento.

Assinatura do investigador responsável: _____.

Data de assinatura: _____/_____/_____.

NOTA: Este documento é feito em duas vias: uma via para o processo e outra para ficar na posse da pessoa que consente.

Appendix C: Caderno de recolha de dados (Case Report Form)

Identificação do participante (codificação): _____. Data: ___/___/_____.

Caderno de recolha de dados

O efeito das manobras posturais na segurança e eficácia da deglutição em pessoas com cancro de cabeça e pescoço

Investigador principal

Gonçalo Calçada Bernardes

Orientador

Célia Soares

Coorientador

David Nascimento

Serviço de otorrinolaringologia do Hospital de Egas Moniz

Unidade Local de Saúde de Lisboa Ocidental

Ano letivo 2024/2025

Critérios de inclusão

O participante cumpre os critérios de inclusão? (assinalar com X)	Sim	Não
Apresenta perturbação da deglutição (PD) ou queixas/sintomas de PD		
PD causada por CCP		

Consentimento informado

O participante leu atentamente a folha de informação e assinou devidamente o consentimento informado? (assinalar com X)	Sim	Não
Leu atentamente a folha de informação ao participante.		
Assinou devidamente o formulário de consentimento informado.		

Sinalização de alergias e/ou intolerâncias alimentares

O participante possui alergias e/ou intolerâncias conhecidas?	Sim	Não
Apresenta intolerância a algum dos seguintes produtos: leite (lactose), soja, trigo (glúten), frutos secos e/ou marisco.		
Possui alergias a algum anestésico e/ou, até à data, apresentou efeitos adversos após a utilização de algum tipo de anestesia.		

Despiste cognitivo

O participante possui alterações cognitivas?	Sim	Não
Pontuações que indicam a presença de alterações cognitivas no (MMSE): • Pontuação < 15 pontos em pessoas analfabetas; • Pontuação < 22 para pessoas entre 1 - 11 anos de literacia; • Pontuação < 27 para pessoas com mais de 11 anos de literacia.		

Formulário de recolha de dados sociodemográficos

Identificação do participante (codificação): _____.

Sexo: Masculino ☐ Feminino ☐

Idade: _____.

Atividade profissional: _____.

Localização e extensão do CCP (T_N_M_): _____

_____.

Realizou-se intervenção cirúrgica? Se sim, descreva especificamente. _____

_____

_____.

Realização de quimioterapia: Sim ☐ Não ☐

Descreva as especificamente (tempo/frequência de tratamento, data de início): _____

_____.

Realização de radioterapia: Sim ☐ Não ☐

Descreva as especificamente (tempo/frequência de tratamento, data de início): _____

_____.

Tem alguma alergia e/ou intolerância alimentar conhecida? Sim ☐ Não ☐

Se sim, especifique. _____.

Queixas de perturbações da deglutição: Sim ☐ Não ☐ Se sim, há quanto tempo?

_____.

Alimentação via oral: Sim ☐ Não ☐

Alimentação por via alternativa: Sim ☐ Não ☐

Se sim, qual? _____. Há quanto tempo? _____.

Mini Mental State Examination (MMSE)

1. Orientação (1 ponto por cada resposta correcta)

Em que ano estamos? _____
Em que mês estamos? _____
Em que dia do mês estamos? _____
Em que dia da semana estamos? _____
Em que estação do ano estamos? _____

Nota:____

Em que país estamos? _____
Em que distrito vive? _____
Em que terra vive? _____
Em que casa estamos? _____
Em que andar estamos? _____

Nota:____

2. Retenção (contar 1 ponto por cada palavra correctamente repetida)

"Vou dizer três palavras; queria que as repetisse, mas só depois de eu as dizer todas; procure ficar a sabê-las de cor".
Pêra _____
Gato _____
Bola _____

Nota:____

3. Atenção e Cálculo (1 ponto por cada resposta correcta. Se der uma errada mas depois continuar a subtrair bem, consideram-se as seguintes como correctas. Parar ao fim de 5 respostas)

"Agora peço-lhe que me diga quantos são 30 menos 3 e depois ao número encontrado volta a tirar 3 e repete assim até eu lhe dizer para parar".
27_ 24_ 21 _ 18_ 15_

Nota:____

4. Evocação (1 ponto por cada resposta correcta.)

"Veja se consegue dizer as três palavras que pedi há pouco para decorar".
Pêra _____
Gato _____
Bola _____

Nota:____

5. Linguagem (1 ponto por cada resposta correcta)

a. "Como se chama isto? Mostrar os objectos:
Relógio ____
Lápis_____

Nota:____

b. "Repita a frase que eu vou dizer: O RATO ROEU A ROLHA"

Nota:____

c. "Quando eu lhe der esta folha de papel, pegue nela com a mão direita, dobre-a ao meio e ponha sobre a mesa"; dar a folha segurando com as duas mãos.
Pega com a mão direita____
Dobra ao meio ____
Coloca onde deve____

Nota:____

d. "Leia o que está neste cartão e faça o que lá diz". Mostrar um cartão com a frase bem legível, "FECHE OS OLHOS"; sendo analfabeto lê-se a frase.
Fechou os olhos____

Nota:____

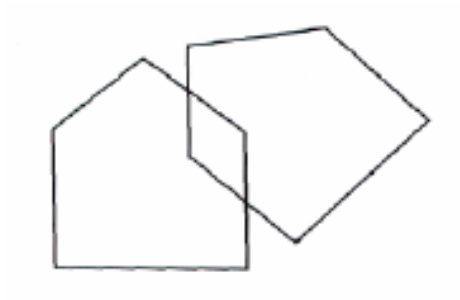
e. "Escreva uma frase inteira aqui". Deve ter sujeito e verbo e fazer sentido; os erros gramaticais não prejudicam a pontuação.

Frase:

Nota:____

6. **Habilidade Construtiva** (1 ponto pela cópia correcta.)

Deve copiar um desenho. Dois pentágonos parcialmente sobrepostos; cada um deve ficar com 5 lados, dois dos quais intersectados. Não valorizar tremor ou rotação.



Cópia:

Nota:____

TOTAL(Máximo 30 pontos):____

Procedimentos para a realização da VED

Sequência de procedimentos para a recolha de dados durante a VED:

Durante a realização da videoendoscopia da deglutição (VED), o investigador deve orientar-se pela seguinte ordem, devendo assinalar com um X no ☐ à medida que vai progredindo na oferta de líquidos (e.g., IDDSI 0, IDDSI 4), bem como na solicitação ao participante para implementar as diversas manobras posturais em estudo.

1. **Ausência de manobra postural – IDDSI 0** [M1-0-T_-____ (codificação)]

Instrução: "Engula".

1.1. ***Oferta nº 1*** [M1-0-T1-____ (codificação)]

- Oferta de 5 mL de líquido fino (IDDSI 0); ☐
- Registo fotográfico da cavidade oral; ☐

1.2. ***Oferta nº 2*** [M1-0-T2-____ (codificação)]

- Oferta de 5 mL de líquido fino (IDDSI 0); ☐
- Registo fotográfico da cavidade oral; ☐

1.3. ***Oferta nº 3*** [M1-0-T3-____ (codificação)]

- Oferta de 5 mL de líquido fino (IDDSI 0); ☐
- Registo fotográfico da cavidade oral; ☐

2. **Flexão de cabeça – IDDSI 0** [M2-0-T_-____ (codificação)]

Instrução: "Baixe a cabeça, queixo ao peito. Engula".

2.1. ***Oferta nº 1*** [M2-0-T1-____ (codificação)]

- Oferta de 5 mL de líquido fino (IDDSI 0); ☐
- Registo fotográfico da cavidade oral; ☐

2.2. ***Oferta nº 2*** [M2-0-T2-____ (codificação)]

- Oferta de 5 mL de líquido fino (IDDSI 0); ☐
- Registo fotográfico da cavidade oral; ☐

2.3. ***Oferta nº 3*** [M2-0-T3-____ (codificação)]

- Oferta de 5 mL de líquido fino (IDDSI 0); ☐
- Registo fotográfico da cavidade oral; ☐

3. **Extensão de cabeça – IDDSI 0** [M3-0-T_-____ (codificação)]

Instrução: "Levante a cabeça, queixo para cima. Engula".

3.1. ***Oferta nº 1*** [M3-0-T1-____ (codificação)]

- Oferta de 5 mL de líquido fino (IDDSI 0); ☐
- Registo fotográfico da cavidade oral; ☐

3.2. ***Oferta nº 2*** [M3-0-T2-____ (codificação)]

- Oferta de 5 mL de líquido fino (IDDSI 0); ☐
- Registo fotográfico da cavidade oral; ☐

3.3. ***Oferta nº 3*** [M3-0-T3-____ (codificação)]

- Oferta de 5 mL de líquido fino (IDDSI 0); ☐
- Registo fotográfico da cavidade oral; ☐

4. **Rotação de cabeça para o lado lesado – IDDSI 0** [M4-0-T_-____ (codificação)]

Instrução: "Rode a cabeça para o lado (esquerdo/direito), queixo a apontar para o ombro (esquerdo/direito). Engula".

4.1. ***Oferta nº 1*** [M4-0-T1-____ (codificação)]

- Oferta de 5 mL de líquido fino (IDDSI 0); ☐
- Registo fotográfico da cavidade oral; ☐

4.2. ***Oferta nº 2*** [M4-0-T2-____ (codificação)]

- Oferta de 5 mL de líquido fino (IDDSI 0); ☐
- Registo fotográfico da cavidade oral; ☐

4.3. ***Oferta nº 3*** [M4-0-T3-____ (codificação)]

- Oferta de 5 mL de líquido fino (IDDSI 0); ☐
- Registo fotográfico da cavidade oral; ☐

5. **Rotação de cabeça para lado não lesado – IDDSI 0** [M5-0-T_-____ (codificação)]

Instrução: "Rode a cabeça para o lado (esquerdo/direito), queixo a apontar para o ombro (esquerdo/direito). Engula".

5.1. ***Oferta nº 1*** [M5-0-T1-____ (codificação)]

- Oferta de 5 mL de líquido fino (IDDSI 0); ☐
- Registo fotográfico da cavidade oral; ☐

5.2. *Oferta nº 2* [M5-0-T2-____ (codificação)]

- Oferta de 5 mL de líquido fino (IDDSI 0); ☐
- Registo fotográfico da cavidade oral; ☐

5.3. *Oferta nº 3* [M5-0-T3-____ (codificação)]

- Oferta de 5 mL de líquido fino (IDDSI 0); ☐
- Registo fotográfico da cavidade oral; ☐

. Ausência de manobra postural – IDDSI 4 [M1-4-T_-____ (codificação)]

ıstrução: "Engula".

6.1. *Oferta nº 1* [M1-4-T1-____ (codificação)]

- Oferta de 5 mL de líquido extremamente espesso (IDDSI 4); ☐
- Registo fotográfico da cavidade oral; ☐

6.2. *Oferta nº 2* [M1-4-T2-____ (codificação)]

- Oferta de 5 mL de líquido extremamente espesso (IDDSI 4); ☐
- Registo fotográfico da cavidade oral; ☐

6.3. *Oferta nº 3* [M1-4-T3-____ (codificação)]

- Oferta de 5 mL de extremamente espesso (IDDSI 4); ☐
- Registo fotográfico da cavidade oral; ☐

. Flexão de cabeça – IDDSI 4 [M2-4-T_-____ (codificação)]

ıstrução: "Baixe a cabeça, queixo ao peito. Engula".

7.1. *Oferta nº 1* [M2-4-T1-____ (codificação)]

- Oferta de 5 mL de líquido extremamente espesso (IDDSI 4); ☐
- Registo fotográfico da cavidade oral; ☐

7.2. *Oferta nº 2* [M2-4-T2-____ (codificação)]

- Oferta de 5 mL de líquido extremamente espesso (IDDSI 4); ☐
- Registo fotográfico da cavidade oral; ☐

7.3. *Oferta nº 3* [M2-4-T3-____ (codificação)]

- Oferta de 5 mL de líquido extremamente espesso (IDDSI 4); ☐
- Registo fotográfico da cavidade oral; ☐

8. Extensão de cabeça – IDDSI 4 [M3-4-T_-____ (codificação)]

Instrução: "Levante a cabeça, queixo para cima. Engula".

8.1. *Oferta nº 1* [M3-4-T1-____ (codificação)]

- Oferta de 5 mL de líquido extremamente espesso (IDDSI 4); ☐
- Registo fotográfico da cavidade oral; ☐

8.2. *Oferta nº 2* [M3-4-T2-____ (codificação)]

- Oferta de 5 mL de líquido extremamente espesso (IDDSI 4); ☐
- Registo fotográfico da cavidade oral; ☐

8.3. *Oferta nº 3* [M3-4-T3-____ (codificação)]

- Oferta de 5 mL de líquido extremamente espesso (IDDSI 4); ☐
- Registo fotográfico da cavidade oral; ☐

9. Rotação de cabeça para o lado lesado – IDDSI 4 [M4-4-T_-____ (codificação)]

Instrução: "Rode a cabeça para o lado (esquerdo/direito), queixo a apontar para o ombro (esquerdo/direito). Engula".

9.1. *Oferta nº 1* [M4-4-T1-____ (codificação)]

- Oferta de 5 mL de líquido extremamente espesso (IDDSI 4); ☐
- Registo fotográfico da cavidade oral; ☐

9.2. *Oferta nº 2* [M4-4-T2-____ (codificação)]

- Oferta de 5 mL de líquido extremamente espesso (IDDSI 4); ☐
- Registo fotográfico da cavidade oral; ☐

9.3. *Oferta nº 3* [M4-4-T3-____ (codificação)]

- Oferta de 5 mL de líquido extremamente espesso (IDDSI 4); ☐
- Registo fotográfico da cavidade oral; ☐

10. Rotação de cabeça para lado não lesado – IDDSI 4 [M5-4-T_-____ (codificação)]

Instrução: "Rode a cabeça para o lado (esquerdo/direito), queixo a apontar para o ombro (esquerdo/direito). Engula".

10.1. *Oferta nº 1* [M5-4-T1-____ (codificação)]

- Oferta de 5 mL de extremamente espesso (IDDSI 4); ☐
- Registo fotográfico da cavidade oral; ☐

10.2. ***Oferta nº 2*** [M5-4-T2-____ (codificação)]

- Oferta de 5 mL de extremamente espesso (IDDSI 4); ☐
- Registo fotográfico da cavidade oral; ☐

10.3. ***Oferta nº 3*** [M5-4-T3-____ (codificação)]

- Oferta de 5 mL de extremamente espesso (IDDSI 4); ☐
- Registo fotográfico da cavidade oral; ☐

Folha de registo para os avaliadores

Avaliador nº _____ (espaço a preencher pelo investigador principal)

Concordância interavaliadores: _____ (espaço a preencher pelo investigador principal)

Tendo em conta o observado na visualização das gravações audiovisuais da VED, pretende-se que, de acordo com a sua análise, coloque os respetivos valores da *Penetration-Aspiration Scale* (1-8) e *Yale Pharyngeal Residue Severity Rating Scale* (1-5), bem como *Murray-Secretion Scale* (0-3), tempo de reação à deglutição (TRD), escape posterior prematuro (*spillage*) nas respetivas colunas das tabelas apresentadas.

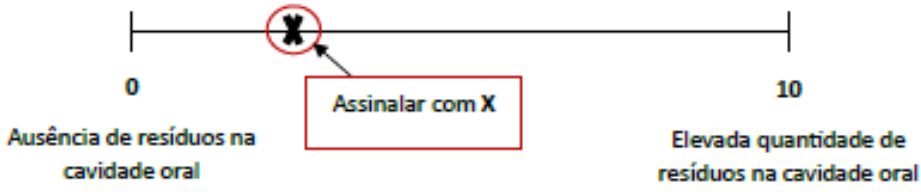
De seguida, pretende-se que assinale com um X na escala visual analógica de quantidade de resíduos na cavidade oral (EVARCO), sendo que uma pontuação igual a zero indica a ausência de resíduos na cavidade oral após a deglutição e uma pontuação igual a 10 representa uma quantidade excessiva de resíduos na cavidade oral após a deglutição (e.g., presença da totalidade do volume de líquido que se pretendia ser deglutido pelo participante). Segue-se um exemplo:

Exemplo de registo de dados

MSS (pontuação baseada nas secreções no início da VED)	1

Vídeo [M_-_-T_-____ (codificação)]	PAS	YPRSRS	TRD	*Spillage*
IDDSI 0 (líquido fino)	3	5	761 ms	Sim

EVARCO



Média TRD [M_-_-T_(codificação)] ($\frac{T1+T2+T3}{3}$): 653 ms.
[Exemplo: T1 = 761 ms; T2 = 656 ms; T3 = 542 ms]

Folha de registo

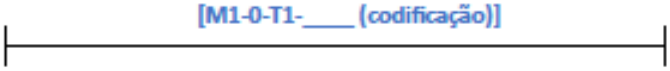
Avaliador nº _____ (espaço a preencher pelo investigador principal)

MSS (pontuação baseada nas secreções no início da VED)	

Vídeo [M1-0-T1-____ (codificação)]	PAS	YPRSRS	TRD	*Spillage*
IDDSI 0 (líquido fino)				

EVARCO

[M1-0-T1-____ (codificação)]



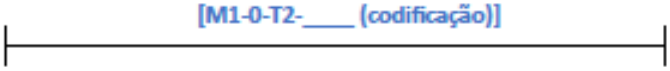
0 — Ausência de resíduos na cavidade oral

10 — Elevada quantidade de resíduos na cavidade oral

Vídeo [M1-0-T2-____ (codificação)]	PAS	YPRSRS	TRD	*Spillage*
IDDSI 0 (líquido fino)				

EVARCO

[M1-0-T2-____ (codificação)]



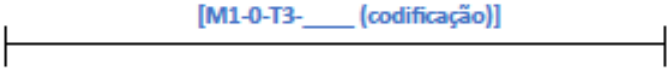
0 — Ausência de resíduos na cavidade oral

10 — Elevada quantidade de resíduos na cavidade oral

Vídeo [M1-0-T3-____ (codificação)]	PAS	YPRSRS	TRD	*Spillage*
IDDSI 0 (líquido fino)				

EVARCO

[M1-0-T3-____ (codificação)]



0 — Ausência de resíduos na cavidade oral

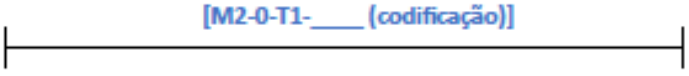
10 — Elevada quantidade de resíduos na cavidade oral

Média TRD [M1-0-____ (codificação)] ($\frac{T1 + T2 + T3}{3}$): ____.

Vídeo [M2-0-T1-____ (codificação)]	PAS	YPRSRS	TRD	*Spillage*
IDDSI 0 (líquido fino)				

EVARCO

[M2-0-T1-____ (codificação)]



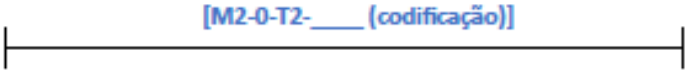
0 — Ausência de resíduos na cavidade oral

10 — Elevada quantidade de resíduos na cavidade oral

Vídeo [M2-0-T2-____ (codificação)]	PAS	YPRSRS	TRD	*Spillage*
IDDSI 0 (líquido fino)				

EVARCO

[M2-0-T2-____ (codificação)]



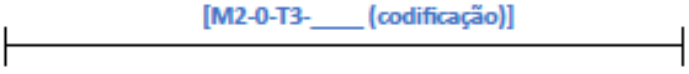
0 — Ausência de resíduos na cavidade oral

10 — Elevada quantidade de resíduos na cavidade oral

Vídeo [M2-0-T3-____ (codificação)]	PAS	YPRSRS	TRD	*Spillage*
IDDSI 0 (líquido fino)				

EVARCO

[M2-0-T3-____ (codificação)]



0 — Ausência de resíduos na cavidade oral

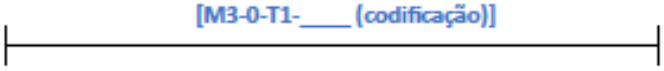
10 — Elevada quantidade de resíduos na cavidade oral

Média TRD [M2-0-____ (codificação)] $\left(\frac{T1 + T2 + T3}{3}\right)$: ____.

Vídeo [M3-0-T1-____ (codificação)]	PAS	YPRSRS	TRD	*Spillage*
IDDSI 0 (líquido fino)				

EVARCO

[M3-0-T1-____ (codificação)]



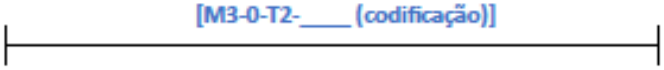
0 — Ausência de resíduos na cavidade oral

10 — Elevada quantidade de resíduos na cavidade oral

Vídeo [M3-0-T2-____ (codificação)]	PAS	YPRSRS	TRD	*Spillage*
IDDSI 0 (líquido fino)				

EVARCO

[M3-0-T2-____ (codificação)]



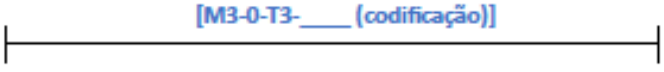
0 — Ausência de resíduos na cavidade oral

10 — Elevada quantidade de resíduos na cavidade oral

Vídeo [M3-0-T3-____ (codificação)]	PAS	YPRSRS	TRD	*Spillage*
IDDSI 0 (líquido fino)				

EVARCO

[M3-0-T3-____ (codificação)]



0 — Ausência de resíduos na cavidade oral

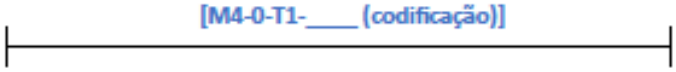
10 — Elevada quantidade de resíduos na cavidade oral

Média TRD [M3-0-____ (codificação)] $\left(\frac{T1 + T2 + T3}{3}\right)$: ____.

Vídeo [M4-0-T1-____ (codificação)]	PAS	YPRSRS	TRD	*Spillage*
IDDSI 0 (líquido fino)				

EVARCO

[M4-0-T1-____ (codificação)]



0 — **10**

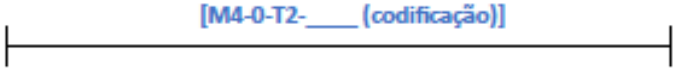
Ausência de resíduos na cavidade oral

Elevada quantidade de resíduos na cavidade oral

Vídeo [M4-0-T2-____ (codificação)]	PAS	YPRSRS	TRD	*Spillage*
IDDSI 0 (líquido fino)				

EVARCO

[M4-0-T2-____ (codificação)]



0 — **10**

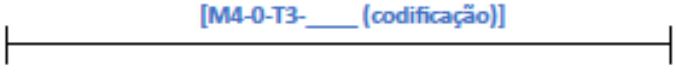
Ausência de resíduos na cavidade oral

Elevada quantidade de resíduos na cavidade oral

Vídeo [M4-0-T3-____ (codificação)]	PAS	YPRSRS	TRD	*Spillage*
IDDSI 0 (líquido fino)				

EVARCO

[M4-0-T3-____ (codificação)]



0 — **10**

Ausência de resíduos na cavidade oral

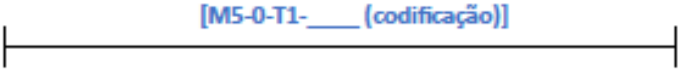
Elevada quantidade de resíduos na cavidade oral

Média TRD [M4-0-____ (codificação)] $(\frac{T1 + T2 + T3}{3})$: ____.

Vídeo [M5-0-T1-____ (codificação)]	PAS	YPRSRS	TRD	*Spillage*
IDDSI 0 (líquido fino)				

EVARCO

[M5-0-T1-____ (codificação)]



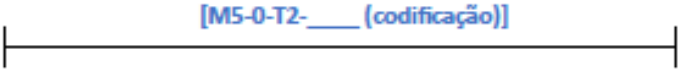
0 — Ausência de resíduos na cavidade oral

10 — Elevada quantidade de resíduos na cavidade oral

Vídeo [M5-0-T2-____ (codificação)]	PAS	YPRSRS	TRD	*Spillage*
IDDSI 0 (líquido fino)				

EVARCO

[M5-0-T2-____ (codificação)]



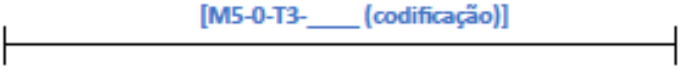
0 — Ausência de resíduos na cavidade oral

10 — Elevada quantidade de resíduos na cavidade oral

Vídeo [M5-0-T3-____ (codificação)]	PAS	YPRSRS	TRD	*Spillage*
IDDSI 0 (líquido fino)				

EVARCO

[M5-0-T3-____ (codificação)]



0 — Ausência de resíduos na cavidade oral

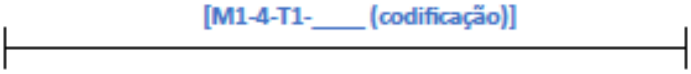
10 — Elevada quantidade de resíduos na cavidade oral

Média TRD [M5-0-____ (codificação)] $\left(\frac{T1+T2+T3}{3}\right)$: ____.

Vídeo [M1-4-T1-____ (codificação)]	PAS	YPRSRS	TRD	*Spillage*
IDDSI 0 (líquido fino)				

EVARCO

[M1-4-T1-____ (codificação)]



0 **10**

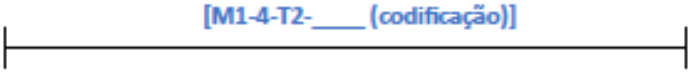
Ausência de resíduos na cavidade oral

Elevada quantidade de resíduos na cavidade oral

Vídeo [M1-4-T2-____ (codificação)]	PAS	YPRSRS	TRD	*Spillage*
IDDSI 0 (líquido fino)				

EVARCO

[M1-4-T2-____ (codificação)]



0 **10**

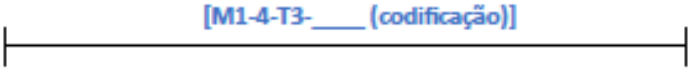
Ausência de resíduos na cavidade oral

Elevada quantidade de resíduos na cavidade oral

Vídeo [M1-4-T3-____ (codificação)]	PAS	YPRSRS	TRD	*Spillage*
IDDSI 0 (líquido fino)				

EVARCO

[M1-4-T3-____ (codificação)]



0 **10**

Ausência de resíduos na cavidade oral

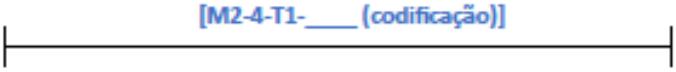
Elevada quantidade de resíduos na cavidade oral

Média TRD [M1-4-____ (codificação)] $\left(\frac{T1 + T2 + T3}{3}\right)$: ____.

Vídeo [M2-4-T1-____ (codificação)]	PAS	YPRSRS	TRD	*Spillage*
IDDSI 0 (líquido fino)				

EVARCO

[M2-4-T1-____ (codificação)]



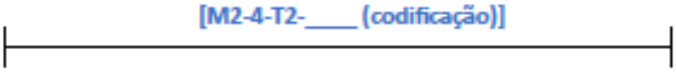
0 — Ausência de resíduos na cavidade oral

10 — Elevada quantidade de resíduos na cavidade oral

Vídeo [M2-4-T2-____ (codificação)]	PAS	YPRSRS	TRD	*Spillage*
IDDSI 0 (líquido fino)				

EVARCO

[M2-4-T2-____ (codificação)]



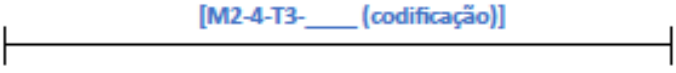
0 — Ausência de resíduos na cavidade oral

10 — Elevada quantidade de resíduos na cavidade oral

Vídeo [M2-4-T3-____ (codificação)]	PAS	YPRSRS	TRD	*Spillage*
IDDSI 0 (líquido fino)				

EVARCO

[M2-4-T3-____ (codificação)]



0 — Ausência de resíduos na cavidade oral

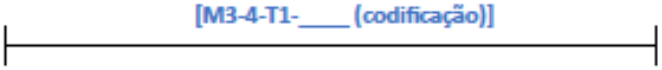
10 — Elevada quantidade de resíduos na cavidade oral

Média TRD [M2-4-____ (codificação)] $\left(\frac{T1 + T2 + T3}{3}\right)$: ____.

Vídeo [M3-4-T1-____ (codificação)]	PAS	YPRSRS	TRD	*Spillage*
IDDSI 0 (líquido fino)				

EVARCO

[M3-4-T1-____ (codificação)]



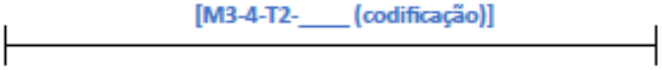
0 — Ausência de resíduos na cavidade oral

10 — Elevada quantidade de resíduos na cavidade oral

Vídeo [M3-4-T2-____ (codificação)]	PAS	YPRSRS	TRD	*Spillage*
IDDSI 0 (líquido fino)				

EVARCO

[M3-4-T2-____ (codificação)]



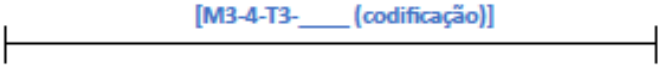
0 — Ausência de resíduos na cavidade oral

10 — Elevada quantidade de resíduos na cavidade oral

Vídeo [M3-4-T3-____ (codificação)]	PAS	YPRSRS	TRD	*Spillage*
IDDSI 0 (líquido fino)				

EVARCO

[M3-4-T3-____ (codificação)]



0 — Ausência de resíduos na cavidade oral

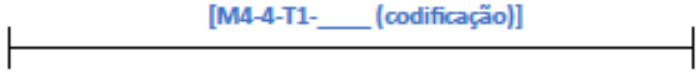
10 — Elevada quantidade de resíduos na cavidade oral

Média TRD [M3-4-____ (codificação)] $\left(\frac{T1 + T2 + T3}{3}\right)$: ____.

Vídeo [M4-4-T1-____ (codificação)]	PAS	YPRSRS	TRD	*Spillage*
IDDSI 0 (líquido fino)				

EVARCO

[M4-4-T1-____ (codificação)]



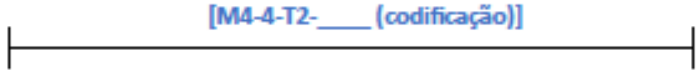
0 — Ausência de resíduos na cavidade oral

10 — Elevada quantidade de resíduos na cavidade oral

Vídeo [M4-4-T2-____ (codificação)]	PAS	YPRSRS	TRD	*Spillage*
IDDSI 0 (líquido fino)				

EVARCO

[M4-4-T2-____ (codificação)]



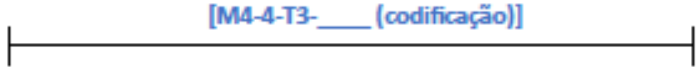
0 — Ausência de resíduos na cavidade oral

10 — Elevada quantidade de resíduos na cavidade oral

Vídeo [M4-4-T3-____ (codificação)]	PAS	YPRSRS	TRD	*Spillage*
IDDSI 0 (líquido fino)				

EVARCO

[M4-4-T3-____ (codificação)]



0 — Ausência de resíduos na cavidade oral

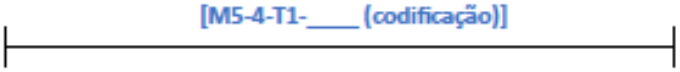
10 — Elevada quantidade de resíduos na cavidade oral

Média TRD [M4-4-____ (codificação)] $\left(\frac{T1+T2+T3}{3}\right)$: ____.

Vídeo [M5-4-T1-____ (codificação)]	PAS	YPRSRS	TRD	*Spillage*
IDDSI 0 (líquido fino)				

EVARCO

[M5-4-T1-____ (codificação)]



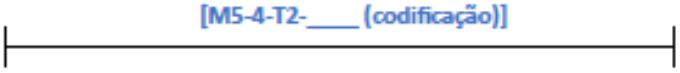
0 — Ausência de resíduos na cavidade oral

10 — Elevada quantidade de resíduos na cavidade oral

Vídeo [M5-4-T2-____ (codificação)]	PAS	YPRSRS	TRD	*Spillage*
IDDSI 0 (líquido fino)				

EVARCO

[M5-4-T2-____ (codificação)]



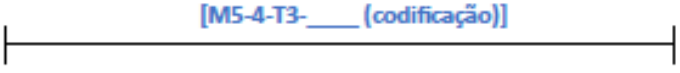
0 — Ausência de resíduos na cavidade oral

10 — Elevada quantidade de resíduos na cavidade oral

Vídeo [M5-4-T3-____ (codificação)]	PAS	YPRSRS	TRD	*Spillage*
IDDSI 0 (líquido fino)				

EVARCO

[M5-4-T3-____ (codificação)]



0 — Ausência de resíduos na cavidade oral

10 — Elevada quantidade de resíduos na cavidade oral

Média TRD [M5-4-____ (codificação)] $\left(\frac{T1 + T2 + T3}{3}\right)$: ____.

11. Annexes

Annex A: Penetration-Aspiration Scale

Table 2 Penetration Aspiration Scale (PAS)

Score	Description
1	Material does not enter the airway
2	Material enters the airway, remains above the vocal folds, and is ejected from the airway
3	Material enters the airway, remains above the vocal folds, and is not ejected from the airway
4	Material enters the airway, contacts the vocal folds, and is ejected from the airway
5	Material enters the airway, contacts the vocal folds, and is not ejected from the airway
6	Material enters the airway, passes below the vocal folds, and is ejected into the larynx or out of the airway
7	Material enters the airway, passes below the vocal folds, and is not ejected out of the trachea despite effort
8	Material enters the airway, passes below the vocal folds, and no effort is made to eject

Annex B: Yale Pharyngeal Residue Severity Rating Scale

Table 1 English and Portuguese version of the scale

English version			
Vallecula			
I	None	0%	No residue
II	Trace	1–5%	Trace coating of the mucosa
III	Mild	5–25%	Epiglottic ligament visible
IV	Moderate	25–50%	Epiglottic ligament covered
V	Severe	> 50%	Filled to epiglottic rim
Pyriform Sinus			
I	None	0%	No residue
II	Trace	1–5%	Trace coating of the mucosa
III	Mild	5–25%	Up wall to quarter full
IV	Moderate	25–50%	Up wall to half full
V	Severe	> 50%	Filled to aryepiglottic fold
European Portuguese version			
Valéculas			
I	Nenhum	0%	Sem resíduos.
II	Vestigial	1–5%	Vestígios sobre a mucosa.
III	Ligeiro	5–25%	Ligamento glossoepiglótico visível.
IV	Moderado	25–50%	Ligamento glossoepiglótico coberto.
V	Severo	> 50%	Valéculas preenchidas até ao bordo epiglótico.
Seios Piriformes			
I	Nenhum	0%	Sem resíduos.
II	Vestigial	1–5%	Vestígios sobre a mucosa.
III	Ligeiro	5–25%	Até ¼ da parede posterior da faringe e pregas ariepiglóticas preenchidas.
IV	Moderado	25–50%	Até 1/2 da parede posterior da faringe e pregas ariepiglóticas preenchidas.
V	Severo	> 50%	Seios piriformes preenchidos até à prega ariepiglótica.