

Oral Miofunctional Aspects of Patients Diagnosed with Meningioma before and after Surgical Treatment

DOI doi: <https://doi.org/10.32635/2176-9745.RBC.2018v64n2.87>

Aspectos Fonoaudiológicos em Pacientes Diagnosticados com Meningioma antes e após o Tratamento Cirúrgico Aspectos Fonoaudiológicos en Pacientes Diagnosticados con Meningioma antes y después del Tratamiento Quirúrgico

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Abstract

Introduction: Meningiomas are among the most frequent primary intracranial neoplasms, and among the neurological deficiencies caused are speech-language disorders, mainly deglutition and communication deficits. Thus, studies that identify early speech-language disorders are necessary for an adequate therapeutic intervention. This study aims to describe speech-language pathology in patients diagnosed with meningioma before and after surgical treatment. **Case report:** Six individuals with meningioma diagnostics participated in the study hospitalized in a general hospital in Salvador - BA. Participants were submitted to speech and language assessment before and after tumor resection, with application of the protocol of clinical evaluation of speech-language pathology. At the pre-surgical stage, speech-language disorders occurred in a small number of cases, mainly related to mild deficiencies of orofacial motor and mild to moderate dysphagia. Already in the postoperative period, speech-language disorders were frequent, especially regarding swallowing, with involution of the functional oral intake scale and need for speech therapy in all cases. **Conclusion:** It is concluded that the meningioma can cause different speech-language disorders, mainly in swallowing, being more frequent in the post-surgical moment due to the manipulation of the vessels and nerves, being more worrying in posterior cranial regions.

Key words: Meningioma; Deglutition Disorders; Language; Brain Neoplasms.

Resumo

Introdução: Os meningiomas estão entre as neoplasias intracranianas primárias mais frequentes e, entre as deficiências neurológicas causadas, estão as alterações fonoaudiológicas, principalmente os déficits de deglutição e comunicação. Com isso, estudos que identifiquem precocemente as alterações fonoaudiológicas são necessários para uma adequada intervenção terapêutica. Este estudo tem como objetivo descrever os aspectos fonoaudiológicos em pacientes diagnosticados com meningioma antes e após o tratamento cirúrgico. **Relato dos casos:** Participaram da pesquisa seis indivíduos diagnosticados com meningioma internados em um hospital geral de Salvador - BA. Os participantes foram submetidos à avaliação fonoaudiológica antes e após a ressecção do tumor, com aplicação do Protocolo de avaliação clínica fonoaudiológica à beira leito. No momento pré-cirúrgico, as alterações fonoaudiológicas ocorreram em um número pequeno de casos, estando relacionadas principalmente a déficits leves de motricidade orofacial e disfagia de leve a moderada. Já no período pós-operatório, as alterações fonoaudiológicas foram frequentes, principalmente quanto à deglutição, com involução da Escala funcional de ingestão por via oral e necessidade de terapia fonoaudiológica em todos os casos. **Conclusão:** Conclui-se que o meningioma pode acarretar diferentes alterações fonoaudiológicas, principalmente quanto à deglutição, sendo mais frequente no momento pós-cirúrgico em razão da manipulação dos vasos e nervos, e mais preocupante em regiões cranianas posteriores.

Palavras-chave: Meningioma; Transtornos de Deglutição; Linguagem; Neoplasias Encefálicas.

Resumen

Introducción: Los meningiomas están entre las neoplasias intracraniales primarias más frecuentes y entre las deficiencias neurológicas causadas están las alteraciones fonoaudiológicas, principalmente los déficit de deglución y comunicación. Con ello, estudios que identifiquen precozmente las alteraciones fonoaudiológicas son necesarios para una adecuada intervención terapéutica. Este estudio tiene como objetivo describir los aspectos fonoaudiológicos en pacientes diagnosticados con meningioma antes y después del tratamiento quirúrgico. **Relato de casos:** Participaron de la investigación seis individuos diagnosticados con meningioma internados en un hospital general de Salvador - BA. Los participantes fueron sometidos a la evaluación fonoaudiológica antes y después de la resección del tumor, con aplicación del protocolo de evaluación de evaluación clínica fonoaudiológica al borde lecho. En el momento prequirúrgico las alteraciones fonoaudiológicas ocurrieron en un número pequeño de casos, estando relacionadas principalmente a los déficit leves de motricidad orofacial y disfagia de leve a moderada. En el período postoperatorio. las alteraciones fonoaudiológicas fueron frecuentes, principalmente en cuanto a la deglución, con involución de la escala funcional de la ingestión por vía oral y necesidad de terapia fonoaudiológica en todos los casos. **Conclusión:** Se concluye que el meningioma puede acarrear diferentes alteraciones fonoaudiológicas, principalmente en cuanto a la deglución, siendo más frecuente en el momento post-quirúrgico debido a la manipulación de los vasos y nervios, siendo más preocupantes en regiones craneales posteriores. **Palabras clave:** Meningioma; Transtornos de Deglución; Lenguaje; Neoplasias Encefálicas.

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INTRODUCTION

Tumors of the central nervous system are a set of neoplasms originating from support cells of the nervous tissue. They include tumors of the brain, cranial meninges, and intracranial nerves¹. They are rare tumors, accounting for 2% of all known cancers, but with high mortality in adults².

Among the primary intracranial neoplasms, meningiomas are included in the most frequent², representing approximately 15% of all intracranial neoplasms³. They are extra-axial tumors known to occur in various sites within the brain, originating from the arachnoid meningotheelial cells^{4,5}.

They are usually benign (grade I), well-circumscribed, slow-growing, and surgically curable, depending on the location; however, they may display more aggressive behavior, classified as grade II (atypical), some 7% of cases, or grade III (anaplastic or malignant), 3% of cases⁶. They occur most frequently in women, adults, and elderly and are rare in childhood⁵.

Brain tumors can lead to numerous neurological impairments that vary by tumor size, site, and invasiveness^{4,7}. Some international studies point to aphasia and dysphagia as complications of meningeal neoplasms⁸⁻⁹.

Tracheal aspiration resulting from difficulty swallowing is an important symptom that should be considered, potentially leading to compromised pulmonary status, nutritional problems, dehydration, weight loss, pneumonia, and death¹⁰. Communication deficits can also have negative impacts, since they affect language and interfere in the related processes.

Early rehabilitation is important to prevent complications and maximize the patients' functional capacity, improving their quality of life⁴. Thus, studies on early identification of speech-language disorders are necessary for a specialized therapeutic intervention. Therefore, this study aims to describe the oral myofunctional characteristics of patients diagnosed with meningioma before and after surgery.

CASE SERIES REPORT

This was a descriptive longitudinal case series study developed in the Neurosurgery Ward and Neurological Intensive Care Unit (UTI) of the "Roberto Santos" General Hospital (HGRS) in Salvador, Bahia, Brazil. The series consisted of cases of individuals diagnosed with meningioma with indication for surgical treatment. The study excluded cases with other neurological diseases, history of speech-language disorders prior to the diagnosis of meningioma, history of prolonged

orotracheal intubation (exceeding 24 hours), and those with incomplete data.

An active search was performed to recruit these cases from November 2017 to January 2018. After analysis of the medical charts and criteria for participation in the study, a speech-language assessment was performed with the patient in stable condition before and after the tumor resection surgery.

Speech-language assessment was performed with a bedside speech-language clinical assessment protocol (Annex 1) established by the Speech Therapy Service of the HGRS (based on the Dysphagia Risk Evaluation Protocol, DREP or PARD)¹⁰. Pre- and postoperative speech-language assessment included the following aspects: level of consciousness; breathing; feeding route, communication screening (comprehension and expression) based on spontaneous speaking, automatic speech, naming, and repetition; assessment of voice organs; voice quality via the GRBASI scale¹¹; subjective rating of cough as a parameter for airway protection; saliva swallowing test; direct assessment of swallowing (with food); classification on the Functional Oral Intake Scale (FOIS)¹². At the end of the assessment, a therapeutic decision was made as to feeding route. The workup also included sociodemographic factors, tumor location, and surgical complications, based on information from the patients' charts. The collected data were tabulated and the variables were analyzed quantitatively. Due to the small number of cases, no statistical analysis was performed.

The study was approved by the Institutional Review Board of HGRS, under case review 2.381.369, and included a written informed consent form in compliance with the ethical standards in Resolution no. 466/2012 of the Brazilian National Health Council.

Six meningioma cases were recruited for the study, predominantly females, with four women and two men, with age ranging from 37 to 74 years (mean age 55 years).

Sociodemographic data on schooling showed that five of the six cases had incomplete primary education and only one case had complete secondary schooling. As for profession, the sample included two farmers, two housewives, one micro businesswoman, and one tire repairman.

Of the six cases, three had meningioma located in the frontal cortical region, one in the left sphenoid wing (with compression of the frontal and temporal regions), one in the tuberculum sellae, and one in the posterior cranial fossa.

In relation to the surgical procedure, no surgical complications were observed in three cases, while two presented moderate bleeding during craniotomy, and in one case it was not possible to perform total tumor resection due to vascular involvement by the tumor.

In the preoperative assessment, all cases presented adequate level of consciousness in spontaneous ventilation with room air. As for feeding route, five cases were on an exclusive normal oral diet, and one case was using a nasogastric feeding tube as an alternative route to exclusive eating. Concerning communication, all the cases displayed unaltered comprehension, and only one case showed impaired expression.

In the assessment of speech organs, four cases coursed with unaltered facial muscles, one case presented right facial paresis, and one presented left facial paresis. Orosopic examination found partial edentulism, total edentulism, and use of dental prosthesis in two cases in each of the above-mentioned events, without evidence of other alterations. As for strength and mobility of orofacial structure (lips, tongue, and cheeks), four cases presented aspects within normal patterns, one had altered parameters, and one displayed reduced mobility of the cheeks and lips.

On the saliva swallowing test, all the cases presented adequate frequency of spontaneous saliva swallowing with normal cervical auscultation. Cough on command was considered weak in only one case, voice quality was classified as overall grade 0 in five cases and overall grade 1 with slight roughness in one case according to the GRBASI scale.

Direct assessment of swallowing was possible in all the cases. Table 1 shows the results. Three cases were diagnosed as normal swallowing, one with functional swallowing, one with mild dysphagia, and one with moderate dysphagia.

FOIS was applied, based on the conduct following speech-language assessment. Four cases were classified

as level 7 (total oral route without restrictions), one was classified as level 6 (total oral route with multiple consistencies, but with food restrictions), and one was classified as level 2 (dependent on alternative route and minimal oral route for food or liquid). Oral diet with all consistencies and no restrictions was approved for four cases. For one case, oral diet was approved with up to semisolid consistency, and another was maintained on nasogastric tube feeding while oral diet was contraindicated (with training in the oral route during speech therapy).

Following surgery and with the patient clinically stable, a new speech-language assessment was performed. The assessments occurred one to two days after surgery.

At the time of postoperative assessment, five cases showed adequate level of consciousness and one showed altered consciousness. In all six cases, the patients were in spontaneous ventilation with room air. As for feeding route in the immediate postoperative period, two cases were on an exclusive normal oral diet, one was on an exclusive semisolid oral diet, one was on an exclusive semiliquid diet, and two were on nasogastric tube feeding. Postoperative comprehension and expression were considered normal in four cases. In one case, comprehension was considered normal and expression was altered, and another presented impaired communication in both comprehension and expression.

As for speech organs, two cases displayed unaltered facial muscles, two right facial paresis, one left facial paresis, and another bilateral facial paresis. As for strength and mobility of orofacial structures (lips, tongue, and cheeks), four presented all the parameters altered, one presented reduced mobility and strength of the cheeks, and another reduced mobility of the tongue. In the functional evaluation, five cases displayed adequate spontaneous saliva swallowing with normal cervical auscultation, and one case presented absence of spontaneous and on-command saliva swallowing, with presence of rhonchi on cervical auscultation.

Cough on command was considered strong in two cases and weak in three, while one showed no production of cough on command, although cough induced by laryngeal manipulation was considered strong.

Voice quality was classified as overall grade 1 with slight roughness in five cases, while in one case it was not possible to perform vocal assessment, due to the absence of responses on verbal commands.

A direct assessment of swallowing foods was performed in five cases, and in one case it was not possible to proceed with the assessment due to altered level of consciousness and unsatisfactory performance on indirect assessment. Table 2 describes the findings. Five cases obtained a

Table 1. Alterations in swallowing in direct preoperative assessment

Case	Alterations in swallowing	Food consistency
C1	Absence of alterations	All consistencies
C2	Absence of alterations	All consistencies
C3	Positive cervical auscultation Clearing throat/cough Choking Wet voice quality	Liquids*
C4	Absence of alterations	All consistencies
C5	Absence of alterations	All consistencies
C6	Inadequate chewing Increased oral transit time	Semisolid and solid

*In this case, due to poor performance in the direct evaluation with liquid, the evaluation was not continued with other consistencies.

Table 2. Relations between alterations in swallowing and food consistency in the postoperative period in meningioma patients

Case	Alterations in swallowing	Food consistency
C1	Inadequate chewing Increased oral transit time Oral residue Multiple swallows	Semisolid and solid
C2	Inadequate chewing Increased oral transit time	Semisolid and solid
C3	No criteria for direct assessment of swallowing	- - -
C4	Inadequate chewing Increased oral transit time	Semisolid and solid
C5	Increased oral transit time	Semisolid and solid
C6	Inadequate chewing Increased oral transit time Oral residue Multiple swallows	Semisolid and solid

diagnosis of mild dysphagia, and one case presented severe dysphagia. FOIS was reapplied in the postoperative period, and five cases were classified as level 6 (total oral route with multiple consistencies with the need for special preparation or compensations, but with food restrictions) and one was classified as level 1 (NPO). Postoperative speech-language management was defined as to feeding route. Exclusive oral diet with semisolid consistency was approved in five cases, while oral diet was contraindicated in one case.

Table 3 categorizes the principal speech-language disorders found in each case, comparing the preoperative and postoperative assessments. This table considered the GRBASI scale, facial palsy/paresis, screening of communication (comprehension and expression), FOIS, and classification of swallowing.

In all six cases, speech therapy was required after surgery.

DISCUSSION

Meningioma is one of the most frequent primary brain tumors in adults and represents 15% of intracranial tumors and 30% of all tumors of the central nervous system originating from the meningeal coverings of the spinal cord and brain¹³. Alterations in the postoperative period were frequent in the current study, especially in swallowing, with regression on FOIS and the need for speech therapy in all the cases.

The data in the current study are consistent with the findings in the literature^{4-5, 14-16}, reporting proportionally more cases of meningioma in women and in the 40 to 70-year age bracket. The majority of the patients in our sample had incomplete primary education, which can be explained by the target public in the hospital where the study was performed.

According to the literature¹⁷, 60% of intracranial meningiomas occur adjacent to the superior sagittal sinus, in the cerebral cortex, and along the sphenoidal crest. They frequently develop along the skull base (olfactory sulcus, sella turcica, and tentorial and petroclival meningiomas).

Table 3. Speech-language characteristics before and after surgical resection of meningiomas

	Voice		Orofacial motricity		Communication		FOIS		Classification of swallowing	
	Preoperative	Postoperative	Pre	Post	Pre	Post	Pre	Post	Pre	Post
C1	GOROBOA0S0IO	GORTBOA0S0IO	No alterations	Right facial paresis	No alterations	No alterations	7	6	Normal swallowing	Mild dysphagia
C2	GOROBOA0S0IO	GORTBOA0S0IO	No alterations	Right facial paresis	No alterations	No alterations	7	6	Normal swallowing	Mild dysphagia
C3	GOROBOA0S0IO	---	Facial paresis	Bilateral paresis	Altered expression	Altered comprehension and expression	2	1	Moderate oropharyngeal dysphagia	Severe dysphagia
C4	GORTBOA0S0IO	GORTBOA0S0IO	Left facial paresis	Left facial paresis	No alterations	No alterations	7	6	Functional swallowing	Mild dysphagia
C5	GOROBOA0S0IO	GOROBOA0S0IO	No alterations	No alterations	No alterations	Altered expression	7	6	Normal swallowing	Mild dysphagia
C6	GOROBOA0S0IO	GORTBOA0S0IO	No alterations	No alterations	No alterations	No alterations	6	6	Mild oropharyngeal dysphagia	Mild dysphagia

G: overall grade; R: roughness; B: breathiness; A: asthenia; S: strain; I: instability.

The frontal cortical region was the most frequently involved area in the current study, while there were also cases in the skull base, specifically in the sphenoid wing, sella turcica, and posterior fossa. There are thus various possible sites, and the symptoms depend on the location, besides the growth, size, and involvement of the brain tissue¹⁴.

According to most authors¹⁸⁻¹⁹, surgery is the treatment of choice, and most of the published series report total resection in approximately 70% of cases¹⁸. Early diagnosis is important for achieving the best treatment outcomes and to prevent the tumors from reaching areas such as cranial nerves and blood vessels²⁰.

Neurological deficits resulting from meningeal neoplasms are caused by compression of underlying structures⁴, shifting of brain structures, increased intracranial pressure, edema, and surgical manipulation¹⁴. Speech-language disorders are common manifestations in cases of brain tumors, with a range of cognitive, communication, behavioral, and physical deficits that substantially complicate the patient's overall status.

Following surgical intervention, no significant vocal alterations were observed, only mild roughness, which can be explained by the short orotracheal intubation for the procedure²¹. Likewise, the literature does not usually associate vocal changes with meningioma. One study²² showed a rare case of unilateral vocal cord palsy in a meningioma of the jugular foramen. Lesions originating in this area bear an intimate relationship with the lower cranial nerves, while in rare cases signs and symptoms may result from the invasion of cranial nerves IX-XII and include voice changes²².

In this study, alterations of orofacial motricity such as facial paresis were present in the majority of cases in the postoperative period, corroborating the literature^{8,23-24}. One study²³ has reported that surgical manipulation in meningioma cases often leads to cranial nerve injuries, raising discussion on selection of the surgical approach, especially in relation to management of the facial nerve.

Communication, considering the aspects of comprehension and expression, was most severely impaired in the case of the left sphenoid wing tumor, with compression of the frontal and temporal regions. In this case only a partial resection of the tumor was performed due to the involvement of important vessels. The literature¹⁹ shows that alterations in conceptualization and lexical fluency, working memory, mental flexibility, and neuropsychological alterations can be associated with frontoparietal meningioma. Postoperative cognitive and linguistic impairments in meningioma patients have also been widely cited, especially in terms of memory, attention, and expression^{3,14,25}.

As for swallowing, all the cases in the current study showed deficits that led to regression in consistency of the oral diet and regression on the Functional Oral Intake Scale (FOIS), with some level of oropharyngeal dysphagia. The case of sphenoid wing meningioma was also the most devastating for swallowing. A study⁹ showed evolution in the immediate postoperative period with aspiration bronchopneumonia secondary to paresis of the lower cranial nerves. Large-volume meningiomas located in the posterior fossa tend to course with severe and rapidly progressive deterioration⁹ involving important vascular and neural structures²².

Speech-language assessment before and after surgical resection is essential for identifying functional alterations, allowing the necessary approaches to rehabilitation, as defined in other studies²²⁻²³.

CONCLUSION

In conclusion, meningiomas can involve various speech-language disorders, especially in swallowing, more frequent in the postoperative period due to the manipulation of vessels and nerves and more serious in posterior cranial tumors. The speech therapist's presence in the hospital team is essential due to the fundamental role in determining the appropriate feeding route, identifying bronchial aspirations, minimizing complications, and optimizing the patient's communication.

CONTRIBUTIONS

Caroline Sousa Costa contributed to the study's conception, interpretation of the data, writing and critical revision, and approval of the final version for submission. Renata D'Arc Scarpel contributed to the study's conception, interpretation of the data, critical revision, and approval of the final version for publication. Ana Terra Brito de Jesus contributed to the study's conception, interpretation of the data, critical revision, and approval of the final version for publication.

CONFLICT OF INTEREST:

None

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Recebido em 16/05/2018
Aprovado em 18/7/2018

ANNEX 1. BEDSIDE SPEECH-LANGUAGE CLINICAL ASSESSMENT PROTOCOL

ROBERTO SANTOS GENERAL HOSPITAL
SPEECH THERAPY SERVICE

BEDSIDE SPEECH-LANGUAGE CLINICAL ASSESSMENT PROTOCOL

Name: _____ Sex: () F () M Age _____ Unit/bed: _____ Record: _____ Date of assessment: _____ Clinical diagnosis: _____
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1. INDIRECT ASSESSMENT

State of Alertness () Yes () No (patient must be alert for at least 15 minutes)

Level of Consciousness () Alert () Altered _____.

Breathing () Spontaneous O₂ _____ () NIMV () IMV () TRACH _____ Cuff (+)
(-)

Need for aspiration () no () yes Volume aspirated _____

Feeding route () oral consistency _____ () NET/EET () GTM () Parenteral ()
Zero diet

Communication () Comprehension () Expression [N: normal or A: altered]

1.1 Assessment of voice organs:

Facial muscles () Normal () Facial Palsy/Paresis R L Other _____

Oroscopy () Permanent dentition () Dental prosthesis () Partial/total edentulism () Unsatisfactory hygiene

Sialorrhea () () Accumulated saliva in oral cavity () Dry mouth () Mucosal lesions

Appearance of structures (N: normal) or (R: reduced)

Lips: Strength () Mobility () Resting lip seal ()

Tongue: Mobility () Strength () Obs.: _____

Cheeks: Mobility () Strength () Obs.: _____

Soft palate: Mobility () Obs.: _____

Laryngeal excursion (measurement 2 fingers): () Obs.: _____

2. FUNCTIONAL ASSESSMENT

2.1 Saliva Swallowing: () Adequate () Altered { () decreased frequency () absence }

2.2 Cervical Auscultation: () Normal () Presence of rhonchi () Not possible to assess – reason _____

2.3 Cough and/or clearing throat () Yes [Spontaneous/on command] Spontaneous (+)(-) Command (+)(-)
() No

* (+) Strong / (-) Weak

2.4 Voice quality: () Unaltered () Wet voice () Altered *G__ R__ B__ A__ S__ I__

* G- overall grade; R- roughness; B- breathiness; A-asthenia; S-strain; I- instability/ Grade: 0-normal or absent; 1- slight; 2- moderate; 3- severe

3. ONLY FOR TRACHEOSTOMIZED PATIENTS

Type of tracheostomy plastic/silicone () metallic ()

Tolerates deflated cuff () Yes () No

TRACH Occlusion [*Digital* () Yes () No // *Syringe plunger* () Yes () No // *Speaking Valve* () Yes () No

Blue Dye Test (+) (-) () Not applicable

3.1 Impediments to performing swallowing test with diet

() Level of alertness () Level of consciousness () Minimum 24 hours post-extubation (for ETT greater than 48 hours)

() Refuses food () Clinical instability () Zero diet () Unsatisfactory performance on indirect assessment

() Other _____.

3.3 . Direct assessment of swallowing (Material: juice, thickener, bread/soft fruit, cookie, level spoon, 50ml cup, 20 ml syringe)

	1 →		2 →	3 →	4 →
Events present	Semiliquid		Liquid	Semisolid	Solid
	() honey	() pudding			
Extraoral escape					
Inadequate chewing					
Increased oral transit time					
Positive cervical auscultation () before ()during () after swallowing					
Oral residue					
Multiple swallows					
Clearing throat/Cough () before ()during () after swallowing					
Choking					
Post-swallow normalization of cervical auscultation					
Wet voice quality					
Absence of alterations					
Modified Blue Dye Test *	() Immediate positive after 24h		() Late positive	() Negative	

**Positive:* secretion with dye via tracheostomy *Negative:* no secretion with dye via tracheostomy.

4. CONCLUSION

Speech-language diagnosis:

() Normal swallowing () Functional swallowing () Mild dysphagia () Moderate dysphagia
() Serious dysphagia () Severe dysphagia

Functional Oral Intake Scale (FOIS):

- () Level 1: NPO (nothing by mouth)
- () Level 2: Dependent on alternative route and minimum oral diet, food or liquid
- () Level 3: Dependent on alternative route with consistent oral diet, food or liquid
- () Level 4: Total oral route, single consistency

- Level 5: Total oral route with multiple consistencies, but with need for special preparation or compensations
- Level 6: Total oral route with multiple consistencies, without need for special preparation or compensations, but with food restrictions
- Level 7: Total oral route without restrictions

CONDUCT

- Oral diet contraindicated.
- Indirect speech therapy.
- Training of oral route _____
- Oral diet, with the following consistencies approved:
 Liquid **Semiliquid** nectar/ honey/ pudding **Semisolid** **Solid** **All consistencies, without restrictions**
- Serving modality:** Spoon Cup Straw No restrictions Assisted/ Supervised
- Independent.

Observations: _____

Attending speech therapist: _____

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