

Botulismo e disfagia***

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Abstract

Background: botulism is a severe neuroparalytic, of an acute characteristic, afebrile and is caused by the action of a toxin produced by *Clostridium botulinum*. This toxin links itself to the receptors of the axon membrane of the motor neurons, preventing the release of acetylcholine in the neuromuscular junction, causing flaccid paralysis of the cranial nerves and skeleton musculature. Aim: to present the speech therapy procedures adopted with a patient with botulism and who was presenting dysphagia. Method: a male adult, with botulism, sent for a speech-language evaluation due to the presence of difficulties when swallowing saliva. During the evaluation the following was observed: alteration in mobility, tonicity and sensibility of the organs of the Orofacial Myofunctional System (OMSs); reduction of the laryngeal movements; stasis of saliva in the oral cavity; absence of the swallowing reflex; absence of the swallowing function. Nine speech therapy sessions were carried out with the following procedures: stimulation of the OMSs - mobility, tonicity and sensibility; stimulation of the oral and pharyngeal reflexes; tests and trainings for swallowing with different food consistencies and with the help of maneuvers aiming at the protection and clearing of the airways. Results: improvement in mobility, tonicity and sensibility of the OMSs; improvement in the elevation of the larynx; re-establishment of the swallowing function without the assistance of other professionals or clinical maneuvers; vocal quality close to the normal parameters (light hypernasality and pneumophonarticulatory incoordination). The patient was discharged from hospital and speech therapy; clinical assistance for adjustment and improvement of the OMSs was suggested. Conclusion: speech therapy demonstrated to be efficient in the re-establishment of OMSs and of the swallowing function, enabling the patient to restore the adequate functionality of his orofacial myofunctional system.

Key Words: Botulism; Deglutition; Deglutition Disorders; Rehabilitation.

Resumo

Tema: o botulismo é uma doença neuroparalítica grave, de caráter agudo, afebril e causada pela ação de uma toxina produzida pelo *Clostridium botulinum*. Essa toxina se liga aos receptores da membrana do axônio dos neurônios motores, impedindo a liberação de acetilcolina na junção neuromuscular, o que causa paralisia flácida dos nervos cranianos e da musculatura esquelética, estruturas responsáveis pela adequada funcionalidade da deglutição nos indivíduos. Objetivo: apresentar o trabalho fonoaudiológico realizado junto a um paciente com quadro clínico de botulismo com queixa de disfagia. Método: paciente adulto, gênero masculino, com quadro clínico de botulismo, encaminhado para avaliação fonoaudiológica por apresentar dificuldades em deglutir saliva. Durante avaliação observou-se: alteração na mobilidade, tonicidade e sensibilidade dos órgãos do Sistema Miofuncional Orofacial (OMSs); redução dos movimentos laríngeos; estase de saliva em cavidade oral; ausência do reflexo de deglutição; ausência da função de deglutição. Foram realizadas nove sessões de fonoterapia, nas quais se abordou: estimulação dos OMSs - mobilidade, tonicidade e sensibilidade; estimulação dos reflexos orais e faríngeos; testes e treinos de deglutição com diferentes consistências alimentares e com auxílio de manobras de proteção e de limpeza de vias aéreas. Resultados: melhora da mobilidade, tonicidade e sensibilidade dos OMSs; presença do reflexo de deglutição; melhora da elevação laríngea; restabelecimento da função de deglutição sem necessidade de assistência de qualquer profissional ou de manobras clínicas; qualidade vocal próxima aos parâmetros de normalidade (hipernasalidade e incoordenação pneumofonarticulatória leves). Paciente recebeu alta fonoaudiológica e hospitalar, sendo indicado atendimento clínico para adequação e aperfeiçoamento dos OMSs. Conclusão: o trabalho fonoaudiológico mostrou-se eficiente no restabelecimento dos OMSs e da função da deglutição, possibilitando que o paciente restabelecesse a funcionalidade adequada de seu sistema miofuncional orofacial.

Palavras-Chave: Botulismo; Deglutição; Disfagia; Reabilitação.

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Introduction

Deglutition is an involuntary complex sensory motor behavior which coordinates the contraction and inhibition of the muscles of the mouth, tongue, pharynx, larynx and esophagus (Ertekin & Aydogdu 2003). During the act of deglutition different levels of the central nervous system are involved, and several muscles which are innervated by the cranial nerves are sequentially stimulated or inhibited in order to move the bolus from the mouth to the stomach (Miller 1982; Jean 1984a, 1984b, 2001; Donner et al. 1995; Broussard and Altschuler 2000).

Swallowing disorders, also known as dysphagia, can result from neurological and/or structural factors, causing problems in the oral cavity, pharynx, esophagus and/or gastro esophageal junction (Asha 2004). Given this situation, one can observe food entering the airways resulting in cough, suffocation/asphyxiation, pulmonary problems and aspiration, nutritional deficits, dehydration, pneumonia and death. (Asha, 2004; Davies et al., 1995; Ott, 1998; Perry & Love, 2001; Doria et al., 2003).

The literature points that speech-language pathologists are the most indicated professionals to evaluate and treat swallowing disorders (Asha, 2001; Asha, 2004; Hinds & Willes, 1998). This professional should be part of the team of health professionals, having the task of preventing and reducing complications resulting from this alteration (Asha, 2001; Asha, 2004; Hinds & Willes, 1998; Ott, 1998; Logemann & Sonies, 2004), and therefore contributing for the reduction in the time spent at the hospital and in the index of hospital stays due to complications (Hinchey et al., 2005; Hammond e Goldstein, 2006)

The purpose of this study is to present the speech therapy procedures adopted with a patient with botulism and who was presenting dysphagia. The speech-language procedures consisted of assessment and therapy until there was a total remission of the disorder.

Review of the literature

Botulism is a serious neuroparalytic disorder, of an acute characteristic, afebrile and is caused by the action of a toxin produced by *Clostridium botulinum* (Cecchini et al., 1996; Rifki, 2000; Sandrock & Murin, 2001; Harvey et al., 2002; Middaugh et al., 2003; Marks, 2004; Hutzler, 2005). This is a gram-positive bacillus, anaerobic and

sporulated, largely distributed in nature: in the soil, in lakes and seas, in food, in honey, in the organs of mammals, fish and crustaceous (Cecchini et al., 1996; Sandrock e Murin, 2001; Merrison et al., 2002; Brett et al., 2004; Bhutani et al., 2005; Hutzler, 2005).

The botulinic toxin is a protein that presents seven different types of antigens indicated by the letters A to G. Among these, the types A, B, E and F are the most toxic to men (Cecchini et al., 1996; Harvey et al., 2002; Brett et al., 2004; Marks, 2004; Bhutani et al., 2005; Hutzler, 2005). It is easily denatured in normal environment conditions: inactivated in 12 hours when suspended in air; in one to three hours when exposed to sunlight; in 30 minutes when heated at 80 degrees and in a few minutes when heated at 100 degrees; in 20 minutes when in the water (3mg/L of chlorine) (Hutzler, 2005).

The toxin is formed by two polypeptide units (chains A and B). The B, or heavy, chain connects itself to the receptors of the axon membrane of motor neurons, penetrating by endocytosis. The A, or light, chain exerts its cytotoxic effect, cleaving itself from proteins that form the synaptic fusion complex. These proteins are the mediators of the fusion process between the synaptic vesicle and the terminal membrane. As the synaptic vesicles, full of acetylcholine, are prevented from accomplishing fusion, acetylcholine is not liberated in the neuromuscular junction, having as a consequence the paralysis of the muscle fiber (Merrison et al., 2002; Brett et al., 2004; Marks, 2004; Bhutani et al., 2005; Hutzler, 2005). The pre-synaptic inhibition affects not only the autonomous cholinergic receptors but also the motor receptors (Hutzler, 2005). This mechanism of interrupting neurotransmission, of an irreversible character and shared by all seven types of toxin, causes flaccid paralyzes of the cranial nerves and of the skeleton muscles (Cecchini et al., 1996; Hutzler, 2005).

The incubation period can vary depending on the form of transmission and on the quantity of absorbed toxin (Cecchini et al., 1996); from 12 hours to three days (Cecchini et al., 1996; Hutzler, 2005). The shorter the incubation period, the more severe the disease due to the action of a larger quantity of toxin (Hutzler, 2005).

Food botulism is related to the inadequate conservation and preparation of contaminated food. The toxin penetrated through the digestive mucosa, reaching the blood stream (Cecchini et al., 1996; Harvey et al., 2002; Brett et al., 2004; Marks, 2004; Bhutani et al., 2005; Hutzler, 2005).

Cases of botulism due to wounds occur through punctiform wounds, open fractures, lacerations, crushes, gun wounds, abscess caused by the use of illicit drugs and surgical incisions, where the *Clostridium* finds an ideal place to proliferate (Cecchini et al., 1996; Sandrock e Murin, 2001; Harvey et al., 2002; Merrison et al., 2002; Brett et al., 2004; Marks, 2004; Bhutani et al., 2005; Hutzler, 2005).

In the infant botulism an intestinal colonization occurs after the ingestion of *Clostridium botulinum* spores (Cecchini et al., 1996; Harvey et al., 2002; Brett et al., 2004; Marks, 2004; Bhutani et al., 2005; Hutzler 2005).

Neuromuscular block occurs independently of the form of exposure and of the type of toxin, resulting in similar neurologic manifestations (Brett et al., 2004; McLaughlin et al., 2004). Flaccid paralysis begins in the muscles innervated by the bulb, with the consequent committal of the cranial nerves (Rifki, 2000; Merrison et al., 2002; Brett et al., 2004; Marks, 2004; Hutzler, 2005). The main initial characteristics presented by patients are: visual difficulty (double sight, cloudy vision and ptosis), speech alterations (disarthria, dysphonia) and in swallowing (dysphagia) (Cecchini et al., 1996; Merrison et al., 2002; Brett et al., 2004; Marks, 2004; McGee, 2004; Bhutani et al., 2005; Hutzler, 2005). The level of conscious is maintained since the toxin does not penetrate the brain. However, a certain level of lethargy can be observed due to the onset at the bulb (Hutzler, 2005).

The progression of paralysis evolves to the commitment of the movements of the tongue, palate, cervical muscles, with the presence of difficulties to sustain the head and the thoracic muscles (Cecchini et al., 1996; Rifki, 2000; Brett et al., 2004; Marks, 2004; Hutzler, 2005). Respiratory difficulties are also observed, either by the closure of the glottis or by muscle weakness; entubation is necessary and, frequently, so is the use of mechanic ventilation (Brett et al., 2004; Marks, 2004; Hutzler, 2005). Weakness in the upper and inferior limbs is also present (Cecchini et al., 1996; Marks, 2004; Hutzler, 2005).

In the food and infant botulism, gastrointestinal manifestations can also be present (Brett et al., 2004; Bhutani et al., 2005).

Repercussion of the clinical picture only occurs when new motor branches develop, process which can take from a week to several months (Bhutani et al., 2005; Hutzler, 2005).

The diagnosis of botulism is done based on the epidemiological history, clinical presentation

and use of laboratorial tests (Cecchini et al., 1996; Merrison et al., 2002; Marks, 2004; Hutzler, 2005). Samples of blood (serum), faeces, vomit, gastric content and lesion material, along with a sample of the suspected food, should be collected for the identification of the bacteria and its toxin (Cecchini et al., 1996; Bhutani et al., 2005; Hutzler, 2005).

Treatment consists in the administration of antitoxins (passive immunization) and of intensive clinical support, like the monitoring of the cardiorespiratory function (mechanic ventilation), adequate nutrition (enteral and parenteral), prevention of ulcers (prolonged lying down) and treatment of other complications (Cecchini et al., 1996; Merrison et al., 2002; Marks, 2004; McGee, 2004; Bhutani et al., 2005; Hutzler, 2005).

As soon as the clinical diagnosis is confirmed, the antitoxin should be administered in order to neutralize the circulating toxin that still has not fixed itself (McGee, 2004; Bhutani et al., 2005). This consists of heterologous antibodies, derived from echinus (Marks, 2004; Bhutani et al., 2005; Hutzler, 2005) and can present risk for the development of hyper sensibility (Marks, 2004; Bhutani et al., 2005).

Other considerations should be included, like the use of laxatives, vomit induction and gastric lavage, if the ingestion of the contaminated food or of the spores is recent (Bhutani et al., 2005).

The prevention of food botulism is related to the adequate manipulation of food (Cecchini et al., 1996; Rifki, 2000; Hutzler, 2005).

Botulinic infection does not confer immunity. Experimental vaccines do exist for laboratory or food industry workers who are exposed to bacillus infection or to toxin contamination (Cecchini et al., 1996; Hutzler, 2005).

Method

The participant of this study was an adult patient, male, with 21 years of age, who presented the diagnosis of food botulism due to the ingestion of a chicken pie contaminated by the spores of *Clostridium botulinum*.

This patient was hospitalized at the Intensive Care Unit (ICU) of the Department of Infectious and Parasitose Disease of the Hospital das Clínicas of the School of Medicine of the University of São Paulo in the beginning of January 2006. During this time the patient received intensive clinical support and passive immunization. However, the patient presented a hypersensibility reaction as soon as the antitoxin was administered, being this therapeutic procedure suspended.

The patient remained hospitalized in the ICU for 45 days, where he received, besides the intensive clinical support, treatment from the rehabilitation team.

Speech-language intervention was requested by the medical team and occurred when the patient was already recovering, with 30 days in the ICU. The patient still used tracheostomy with a plastic cannula and a permanently inflated cuff, nasogastric tube, and was in the final process for the removal of mechanic ventilation. The complaint of the medical team was that the patient presented difficulties to swallow saliva, with a constant accumulation of saliva in the mouth and the need of a suction pipe for aspiration - a procedure performed by the patient himself.

A speech-language evaluation was performed, in a single session, with the duration of approximately forty minutes in the ICU. The patient was in a sitting position, approximately at 90 degrees, so that his positioning did not interfere in the results of the research.

The protocol used for evaluation was the Simple screening tool for dysphagia in patients with stroke (DyP) proposed by Nishiwaki et al. (2005), translated and adapted to the Brazilian Portuguese language. This protocol is divided in two sections - oral-motor exam and clinical tests for swallowing - and considers the obtained results as typical or atypical.

After evaluation, nine speech-language therapy sessions were performed, aiming at the rehabilitation of the facial and cervical muscles and the reintroduction of food. Indirect therapy- aiming at the adjustment of the structures through exercises - and direct therapy - reinforcing the appropriate behaviors during swallowing with the use of food in the oral cavity - were performed (Logemann, 1983).

This research received prior approval of the Research Ethics Committee of the Institution (CAPPesq HCFMUSP) and informed consent was obtained from the patient and his family.

Results

Ten speech-language sessions were performed in approximately one month, being the first an evaluation session and the rest dedicated to therapy.

During the speech-language evaluation the following was observed:

- . alterations in the mobility, tonus and strength of

the lips, cheeks and tongue: with a greater impairment related to the decrease in the amplitude of guided movements and presence of tremor during the performance of movements, characterizing a flaccid musculature.

- . alterations regarding laryngeal mobility: severe reduction in the horizontal and vertical movements of the larynx, with a greater compromise of the last.

- . alteration in the sensibility and mobility of soft palate and pharynx: incoordination in the guided mobility of the palate and absence of the GAG reflex was observed.

- . presence of saliva stasis in the oral cavity, needing the constant use of a sucking pipe.

- . absence of the active swallowing of saliva, even after the passive stimulation through tactile and thermal stimulation. The patient begins preparation for the pharyngeal phase, but cannot initiate it due to the absence of the swallowing reflex.

- . clinical tests for swallowing were not performed due to impossibilities.

Given what was observed, it was possible to determine the presence of Severe Oropharyngeal Dysphagia, associated to alterations of the organs and functions of the Oral Myofunctional System. - alterations of lips, tongue and cheeks, soft palate, pharynx and of the functions of breathing, mastication, swallowing and speech, with a greater impairment of the soft palate and pharynx leading to the absence of the swallowing function. The immediate action for this case was the stimulation of the OMOs and periodical reassessments.

Therapeutic procedures consisted of nine therapy sessions in the ICU and infirmary, didactically distributed in five blocks:

Block 1: two therapy sessions with the purpose of stimulating the OMOs and the primitive reflexes. At the end of this block it was possible to verify the presence of the GAG reflex and improvement in the elevation of the larynx. At this moment the option was to momentarily deflate the cuff so that the vocal quality (VQ) could be observed: moderate hypernasality, mild breathiness, high pitch, adequate loudness and an important pneumophonoarticulatory incoordination (PFAI). The test of coloring saliva (blue test) was also performed, but the patient was not able to swallow the material present in the oral cavity (saliva + blue coloring). The test was considered insufficient to draw any conclusions. For this reason it was decided to perform it again later on.

Block 2: two therapy sessions with the same purpose as those of the previous block. In these sessions the cuff remained deflated and the VQ was constantly verified. Data observed through the VQ served as parameters when verifying the patient's development after each therapy procedure. At the end of this block the VQ was hypernasal, with high pitch, adequate loudness and with a significant improvement in the PFAI. The test of coloring saliva was performed once more and this time the patient managed to swallow the material present in the oral cavity (saliva + blue coloring). After this procedure aspiration of the trachea was performed. Escape of the colored material through the tracheostomy tube was not observed. At the end of this block the possibility of performing oral training (OT) assisted by the speech-language therapist was discussed with the medical team.

Block 3: two therapy sessions, where, besides the previous actions, OT assisted by the speech-language therapist with liquid and paste consistencies was performed. An increase in the duration of the oral phase and clinical signs of penetration and/or aspiration was observed after deglutition, being this associated with strong coughing. The therapist worked with maneuvers aiming at the protection and clearing of the airways. Overall, the patient responded very well to this procedure; escape of colored food through the tracheostomy tube even after tracheal aspiration. At the end of this block, the possibility of performing OT assisted by the team of nurses was discussed with the medical team.

Block 4: two therapy sessions, consisting of the stimulation of the OMOs and VT with liquid-paste and paste consistencies assisted by the speech-language therapist and nurses. The patient continued to have an excellent performance, evolving with the decrease in the duration of the oral phase and the decrease of the clinical signs of penetration and/or aspiration. The maneuvers performed in the previous block continued, and with this the clinical signs of penetration and/or aspiration were not observed.

Given the good development of the case, this was considered a propitious moment to perform more objective tests in order to confirm clinical findings and to establish new therapy planning. The possibility of performing a videodeglutogram was discussed with the medical team.

Bloco 5: Videodeglutogram report: normal deglutition.

The possibility of changing the tracheostomy tube from plastic to metal was discussed with the medical team, physiotherapists and nurses.

After the objective exam and change of the tracheostomy tube to a metallic tube, one therapy session was performed for the assessment of the swallowing of solid food. Clinical signs of alterations were not observed.

In speech-language terms the patient was considered ready for oral feeding in all consistencies, with no need for professional assistance and for clinical maneuvers.

Signs of mild hypernasality and PFAI were still present.

The patient was discharged from speech-language hospital intervention and outside clinical assistance was suggested in order to improve and adequate the Orofacial Myofunctional System and vocal aspects.

On this same day the nasogastric tube (NGT) and tracheostomy cannula were removed. The patient was discharged from the hospital four days after being discharged from the speech-language treatment.

Discussion

The presented results represent the muscular and functional characterization of a patient with food botulism and how this patient developed during the speech-language rehabilitation process.

Data obtained in the evaluation point to alterations related to the mobility and tonus of the facial and cervical muscles which, according to the literature, were very compromised due to the action of the toxin in the body (Cecchini et al., 1996; Rifki, 2000; Merrison et al., 2002; Brett et al., 2004; Marks, 2004; McGee, 2004; Bhutani et al., 2005; Hutzler, 2005).

Alterations related to sensibility were also observed, with the absence of sensibility of the pharynx. As verified in the evaluation, the swallowing reflex was not triggered - this is a vital process to start the pharyngeal phase. The sensibility of the pharynx is given by the pharyngeal plexus. This structure is formed by fibers of the cranial nerves, particularly of the Glossopharyngeal (IX) and Vagus (X), that as pointed in the literature are the first anatomic structures to be affected, once the action of the toxin begins at the bulb and travels downwards through

the nervous system (Cecchini et al., 1996; Rifki, 2000; Merrison et al., 2002; Brett et al., 2004; Marks, 2004; Hutzler, 2005).

The results of the speech-language assessment agree with the literature, with alterations of the organs of the Orofacial Myofunctional System, mainly characterized by muscular flaccidity (Cecchini et al., 1996; Rifki, 2000; Merrison et al., 2002; Brett et al., 2004; Marks, 2004; McGee, 2004; Bhutani et al., 2005; Hutzler, 2005) and absence of sensibility in the oropharyngeal region. Swallowing was also compromised, in this case even impossible, fact which is also mentioned as being one of the main and primordial alterations of the pathology (Rifki, 2000; Merrison et al., 2002; Brett et al., 2004; Marks, 2004; Hutzler, 2005).

Due to the irreversibility in the interruption of the neurotransmission of the nervous impulse (Cecchini et al., 1996; Hutzler, 2005) and the information that recovery only occurs when new motor branches develop (Bhutani et al., 2005; Hutzler, 2005), the aim of the speech-language intervention was to slowly and progressively stimulate the compromised structures so that new nervous terminations could be formed and assume the impaired functions.

It is believed that neurologic rehabilitation occurs even without the stimulation offered by speech-language intervention - as observed in most of the cases where the speech-language therapist is not part of the team. However, the presence of this professional can accelerate this process, avoiding undesirable adaptations (Asha, 2001; Asha, 2004; Hinds & Willes, 1998; Ott, 1998; Logemann & Sonies, 2004).

Initially aspects related to the mobility of the organs of the Orofacial Myofunctional System were approached using isotonic exercises (aiming at the mobility) and the primitive reflexes were stimulated using thermotherapy (Logemann, 1983). The patient and his family were asked to maintain this stimulation along with the other daily activities during all of steps of treatment.

After this first stage, given the possibility of maintaining the cuff deflated, it was possible to use the vocal aspects to assist the therapy process, not only to perform exercises (Boone e McFarlane 1994; Belau e Pontes 1995; Mourão 2000), stimulating the muscles of the pharynx and larynx, but also to follow the development of these muscles. With the characterization and the development of the vocal quality it was possible to estimate the improvements presented by the muscles. During this stage the first signs of

swallowing were identified.

With the presence of swallowing, therapeutic procedures involved the training of this function, assisted by the speech-language therapist and later by nurses, with different types of foods and consistencies. At first, this was done with the help of maneuvers aiming at the protection and clearing of the upper airways (Logemann, 1983; Mendelson & Martin, 1993; Furkin, 1999; Behlau & Pontes, 1995). As therapy progressed the use of these maneuvers became unnecessary.

The therapy procedure adopted in the third stage was the use of isometric exercises (build up of strength) associated to isotonic exercises and to sensorial stimulation. In this stage, all muscle capacity was being approached through indirect (use of exercises) and direct (use of functions) stimulation (Logemann, 1983).

With the improvement presented by the patient and with good results observed in such a short period of time, the medical team believed that the performance of an objective test for swallowing would be advantageous (Ott, 1998; Chih Hsiu et al., 1997; Hinds & Willes, 1998; Ertekin & Aydogdu, 2003) in order to prove the absence of any kind of alteration during swallowing. With this, new procedures could be established in order to guarantee success, given the rapid improvement. This procedure was not found in the literature (Bhutani et al., 2005; Hutzler, 2005).

The patient underwent a complementary exam to assess swallowing and the obtained result agreed with the clinical findings - normal deglutition.

Given these results - clinical and complementary - there was no indication, in the opinion of the speech-language therapist, to maintain the cuff inflated and the plastic cannula. This aspect was discussed with the other health professionals - doctors, physiotherapists and nurses - and, as there was no objection, the process of removing the tracheostomy began.

The patient was then considered, after one month of speech-language rehabilitation, apt to receive food of all consistencies orally. However, mild muscle alterations still existed which interfered in the vocal quality and in the PFAI (signs of discreet muscle flaccidity).

With the progress in the process of removing the tracheostomy, oral feeding was slowly and gradually liberated, at first liquids, liquid-paste and paste consistencies in small portions, associated with the alternative form of feeding.

Speech-language conduct in the hospital situation was of dismissal, and therapy was

suggested in the clinic aiming at the total improvement of the remaining alterations. On this same day the nasogastric tube and the tracheostomy cannula were removed.

The other members of the team dismissed the patient after four days of the speech-language dismissal, since the patient was receiving food orally exclusively and was in the final process of closing the tracheostomy with no interurrences.

Conclusion

The speech-language procedures adopted in this case demonstrated to me most effective, since it assisted and redirected the reorganization of muscle activity, of sensory activity and of the Orofacial Myofunctional System, minimizing the deficits presented due to alterations in swallowing. In this way, the presence of a specialized professional provided trustworthy results, and contributed to the reduction in the time of hospitalization and in the index of re-hospitalization due to complications.

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