



FUNDACIÓN SAN JUAN DE JERUSALÉN

ALTERACIONES DE LA DEGLUCIÓN EN PARÁLISIS CEREBRAL

QUITO - ECUADOR

2020

FIFTH ROUND TABLE

DISCUSSION: "Swallowing disorders in cerebral palsy"

DATE: Thursday, June 18, 2020

TARGET AUDIENCE: Pediatricians, speech therapists, physical therapists, and parents of children with infantile cerebral palsy (CP).

Objectives:

- To explain feeding and swallowing processes in children with CP.
- To raise awareness of the importance of using suitable feeding techniques for children with CP.
- To explain the process of correctly stretching and positioning a child with CP, before, during and after feeding.
- To share the experience of the professionals at the Centro San Juan de Jerusalén Foundation in handling the feeding of children with CP.

1. Swallowing in CP



❖ Background information

Katherine Velarde, a pediatrician at the Foundation, explained that, given that swallowing in CP was still an unfamiliar topic for many professionals, the participants in the round table would provide tools for recognizing and managing dysphagia, taking into account that early intervention and detection would be a determining factor in the child's development.

Peter Rosenbaum, one of the world's leading CP experts, defines CP as a group of disorders of the development of movement and posture, which cause activity limitation and are attributed to non-progressive disturbances that occur in the developing fetal or infant brain. Motor disorder is often accompanied by disturbances of sensation, cognition, communication, perception, behavior and/or by epileptic seizures.



The global prevalence is between 1.5 and 4 per 1,000 live births. However, according to the World Health Organization, 242,340 people in Ecuador have cerebral palsy, which is approximately 15 per 1,000 live births.



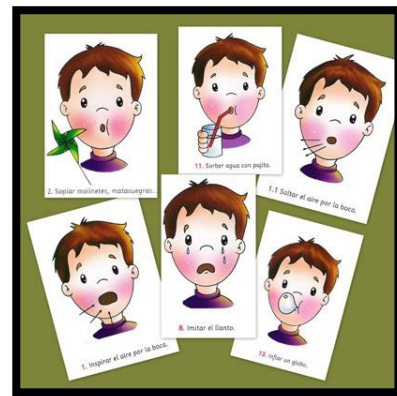
Tardieu said that brain injuries in the prenatal period are followed by disorders in muscle regulation and selective motor control. These disorders are manifested globally in the individual but also specifically in movements of the face, mouth, neck, and orofacial region in general. These motor disorders can lead to postural changes, causing misalignment of the structures responsible for swallowing; incorrect closure of the airway during swallowing; and risk of aspiration, infection and airway blockage.

Brain motor disorders specifically affect orofacial motor skills, leading to:

- voluntary tongue control impairment and tongue protrusion
- exaggerated opening of the mouth
- lip and oropharyngeal hypotonia
- impairment of oral bolus formation and transport timing for reflexive swallowing.

❖ Orofacial motor skills

These skills concern the interaction of the oral and facial muscles to allow adequate feeding and speech. Orofacial motor difficulties depend on the specific structural brain damage, on which the regulation of the orofacial abilities of the affected brain site depends.



❖ Swallowing

Swallowing is a complex, consciously initiated neuromuscular physiological process. It lasts approximately 3 to 8 seconds and transports a bolus or saliva from the mouth to the stomach via the pharynx and the esophagus.

Swallowing requires sensory and motor integration, as well as the regulation and cerebral control of multiple anatomical structures, involving approximately 30 muscles and cranial nerves and close coordination of the nervous and respiratory systems.

- Neural control of swallowing

Katherine also mentioned that this function involves several anatomic components:

- **Anatomical centers:** These are bilateral and act independently.
- **Musculature of the oral cavity, pharynx, upper esophageal sphincter and upper esophagus:** This receives esophageal innervation from motor neurons of the cranial nerves and includes striated (i.e. voluntarily controlled) muscle.

- **Thoracic esophagus:** The lower esophageal sphincter is composed of smooth (i.e. involuntarily controlled) muscle fibers innervated by inhibitory and excitatory neurons of the esophageal myenteric plexus.
- **During swallowing:** Breathing is inhibited by the central nervous system.

❖ Infantile swallowing

The process of infantile swallowing requires rhythmic coordination of sucking, swallowing and breathing. Pulmonary respiratory function begins at birth by cutting the umbilical cord.

- Assessment of orofacial disorders



Katherine mentioned that the diagnostic approach should always begin with clinical suspicion; history taking and physical examination must precede any diagnostic activity.

Orofacial motor skills need to be assessed in every child who has a history of, or risk factors for: prematurity, perinatal hypoxia, diagnosed CP, other developmental disorders, craniofacial or oral cavity malformations, some genetic syndromes, neuromuscular diseases, history of traumatic brain injury, history of recurrent pneumonia, chronic cough, congenital or acquired heart disease, gastrointestinal symptoms, feeding aversion and irritability when feeding.

The assessment of orofacial disorders is twofold:

- **Functional assessment:** Innate motor skills: Tongue, lip, chewing and swallowing functions are assessed.
- **Factorial assessment:** spontaneous, self-initiated and externally provoked movement are evaluated

- Factorial clinical assessment of innate oral motor skills

- **Spontaneous mobility:** Individual movements of the lips, tongue thrust towards the lower lip and slight smiling with no social meaning are evaluated.
- **Self-initiated movement:** If the child is not hungry, the lips close when the examiner's finger lightly touches the epidermal portion of the lips. However, when hungry, the child opens their mouth and eagerly tries to make contact with the examiner's finger. The tongue follows the movement of the finger from one side of the mouth to the other.
- **Externally-provoked movement :** The mouth opens when the examiner touches the upper lip (proprioceptive stimulation), and there are automatic responses from the corners of the mouth, i.e. the mouth moves from one side to the other, depending on where the examiner touches the child's lip.



❖ Penetration, aspiration and choking

Oral motor disorders typical of CP can lead to a series of bronchopulmonary complications, caused by penetration or aspiration (i.e. food or drink "going down the wrong way"). An exhaustive assessment is therefore essential for understanding and a multidisciplinary approach. Following Le Métayer's concept, both positioning and the rehabilitation of the automatic motor programs must be addressed during feeding, giving equal importance to both aspects. Penetration and aspiration can be classified as:

- **Nasal penetration/aspiration:** The swallowing program is triggered, but the soft palate does not rise enough and food goes toward the cavum or the choanae.
- **Tracheal penetration/aspiration:** The aerodigestive tract starts from the site of speech, breathing and swallowing. If these programs cross, during a posture change or the change of the pharynx from an airway to a food channel, there is penetration or aspiration and the cough reflex is the triggered.
- **Silent tracheal penetration/aspiration:** This is very typical in infantile CP because of the decreased coughing reflex and increases the risk of aspiration pneumonia and pneumothorax due to bronchial blockage.

❖ Orofacial problems and feeding in infantile CP

There are a wide range of feeding difficulties linked to the injury of the brain structures used in orofacial motor control. A factorial clinical assessment of the functional

implications should be performed by the neonatology and paediatric services, and the case should be referred to the therapeutic department (speech and physical therapy).

- Main brain motor problems in children with infantile CP



- Basal muscle contractions are no longer transitory
- Impaired prefunctional innate automatisms and reflexes
- Impaired sucking and lingual and pharyngeal peristalsis
- Impaired coughing and swallowing reflexes.

- Orofacial motor disorders in children with infantile CP

General motor disorders in children with CP are displayed in:

- **Control:** With orofacial motor disorder, the child uses their available sensory-motor means, which causes an increase in existing abnormal movements; for example, in the case of a tendency toward tongue protrusion, on close observation, it is noted that the child sticks out their tongue more than normal.
- **Feeding:** Functional difficulties in sucking, taking food, retaining food, salivation, chewing and swallowing.

Active neck extension owing to abnormal posturing of the body axis leads to an imperfect closure of the trachea (penetration/aspiration, coughing), stretching of the muscles down the jaw and the difficulty in closing the dental arches. The base of the tongue deforms and forms into two direct channels to the larynx.

- Classification of phonation and eating disorders according to Tardieu

- **Grade 0:** Motor normality. There are no articulatory or feeding defects.
- **Grade I:** Articulatory and feeding defects are discrete, only detected by a qualified professional.
- **Grade II:** There is clearly an abnormality, but function is possible; in other words, the child articulates and feeds with some obvious difficulty.
- **Grade III:** Function is difficult; the articulatory problems mean that the child is only understood by their closest relatives and that there are feeding and nutritional disorders.
- **Grade IV:** Function is impossible; oral expression is not possible, and the child has severe feeding difficulties, even requiring other mechanisms for feeding.

❖ Orofacial problems and feeding in a premature newborn

The premature infant usually is not very reactive and tires easily. It is vital to recognize if these responses are the norm for the child, because when motor difficulties are due to moderate pathological problems, motor and therapeutic training for feeding must start early, to support the newborn's orofacial motor experiences. Initially, trophic feeding is recommended for newborns in order to improve their orofacial motor skills, rather than for nutritional purposes.

❖ Transient disorders or moderate orofacial motor problems

The following are relatively frequent discrete neurological problems:

- Difficulty in performing gestures and mild articulatory issues.
- The centre of the tongue does not sufficiently depress on contact with the finger, the lateral edges of the tongue rise slightly, and the suction force on the finger is diminished.
- The tongue protrudes exaggeratedly.
- Lack of tip-of-the-tongue selectivity.

These abnormalities require control and/or intervention by the therapist so that the child learns to feed using sufficiently large and effective movements.

2. Physical therapy intervention in orofacial problems

Janeth Dávalos, a physical therapist at the Foundation, mentioned that when there is a child with CP, there is also a group of professionals who work in coordination (in other words, a transdisciplinary team), and both the caregivers and the team responsible for the child must be aware of the child's orofacial or buccofacial issues, their treatment and, in particular, how to feed them and how to deal with orofacial motor problems.

The description of the feeding problem, whether in a baby or in a child, not only contributes to the neurological diagnosis, but also allows the appropriate measures for a safe feeding to be determined. When a child has CP, we must remember that feeding can become a matter of life or death: if the child's swallowing mechanism does not work properly, it will lead to penetration/aspiration, causing an imminent danger of death.

That is why orofacial pathologies must be detected, diagnosed and rehabilitated at an early age in the neonatal unit, rather than later when the child is older.

❖ Sucking



The entire sucking pattern of full-term babies consists of a rhythmic alternation of sucking and expression. Once sucking is mature, it occurs 2,000 times a day — three times per minute during the day and once per minute at night. There are two types of sucking:



- **Nutritive sucking:** This is the main way that the baby receives nourishment.
- **Non-nutritive or trophic sucking:** This has a calming effect on the baby.

Both non-nutritive and nutritive sucking provide information on the baby's oral and motor skills, through sucking, swallowing and breathing, which are important prerequisites for coordinated feeding.

A healthy newborn digests breast milk in 20 minutes. This sucking is practical, rhythmic, strong, steady and efficient; however, in a child who has suffered some kind of health issue, this sucking action can be abnormal, which could indicate that neurological development is not progressing normally. It could also be the first manifestation of possible brain damage, i.e. infantile CP.

It has been observed that babies who suffer severe developmental issues do not generate adequate pressure while sucking and, during the neonatal period, there is no coordination between sucking, swallowing and breathing.

❖ Rehabilitation of neonatal problems



Rehabilitation must be conducted by the neonatal units because good orofacial functioning is needed for feeding and weight gain and also contributes to the child's psychomotor development. Currently, tools from several therapeutic approaches are available:



- Michel Le Métayer's therapeutic training orofacial motor skills (France);
- The protocols of Galaad Torró (Spain); and
- The Fucile protocol (Italy).



❖ Brain motor disorders in children with infantile CP

Before starting any intervention, it is essential to have a factorial clinical assessment, which analyzes the possible problems caused by brain damage. The factorial clinical assessment not only identifies the problems, but also allows the relationships between the existing functional difficulties to be understood and provides precise guidance on training and rehabilitation therapy techniques, allowing the child to be assisted to improve their motor control to make it as functional as possible.



- Swallowing reflex

Like other reflexes, swallowing can be induced by a particular stimulus, by exerting sufficient pressure on the reflexogenous zone on the rear wall of the pharynx. This stimulus makes the larynx ascend at the same time as the epiglottis in order to hermetically close the trachea and let the food bolus pass while the glottis is blocked.

As this reflex cannot be trained or rehabilitated, the intervention is carried out on the entire swallowing function by modifying the anatomical and postural conditions, and by strengthening and helping to synchronize the contractions of the muscles that are normally involved, so that the food bolus, under the effect of peristaltic movements, enters the reflexogenous zone. In this zone, the pressure exerted by the base of the tongue and the epiglottis triggers the swallowing reflex.

- Brain motor disorders that influence orofacial disorders

The children with the most noticeable orofacial disorders are those in grade 3 or 4 of the Tardieu scale; in other words, those who already have a condition concerning torso and head control. Brain motor disorders can be classified as:



○ **Pathological basal muscle contraction:**

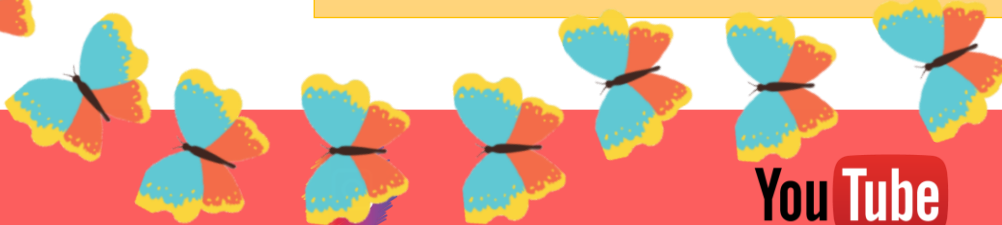
These are irrepressible contractions that happen when resting; that is, the child is not necessarily in a sitting position. They simply occur when the child is resting and are triggered by the child's voluntary movements. These muscle contractions can be athetoid or choreoathetoid movements, displayed in children with CP; are involuntary, and therefore not dependent on the child's will; and cause tiredness because they use a considerable amount of energy.

- **Deficient antigravity control:** Deficient control of the torso against gravity. Antigravity control is present from birth, but when it fails, swallowing conditions become difficult. Muscle contractions increase to try to improve control (i.e. for the child to try to keep upright), so a head support and a jacket to support the torso are always required.



○ **Excessive emotional reactions to intentional effort:**

These emotional reactions of anxiety when making an intentional effort — for instance, keeping the head up when the spoon approaches the child's mouth for feeding — trigger pathological basal contractions and exacerbate functional difficulties; that is, there is uncoordinated arm movement and a hyperextension of the head and torso.



- **Related problems:**

Children who have multiple disabilities have not only motor difficulties but also sensory or cognitive issues, and they may also have digestive, nutritional, respiratory, behavioral and dehydration problems.



- ❖ **Pathological postures**

- **Deer posture**



The "deer posture", as Le Métayer calls it, is commonly displayed in children with cerebral palsy and affects orofacial motor organization. The child's head goes forward and the neck extends, which produces a set of contractions not only in the muscles that control head support, but also in the muscles involved in swallowing and chewing. The deer posture involves a global position of the upper limbs and torso extension; in other words, it causes completely pathological postural organization, making the child move their head backward while projecting the chin forward. In addition, the organization of the scapula and humerus is abnormal.

- **Implications in orofacial mechanics**

These pathological postures have the following anatomical consequences:

- The upper pharyngeal obturators contract and pull the lower jaw backward and pulling the muscles that elevate the upper lip, which causes the lip to lift over the gum.
- The severity of this posture depends on the child.
- The upper fascicles of the obturators make the forward movements of the jaw, that is, when the jaw is retracted the child is unable to drink from a cup.
- In addition, the dental arches (i.e. the lips) are prevented from coming together to close the mouth and swallow.

- This also has implications for the articulation of phonemes, such as "u".

- Neck hyperextension posture

Active neck extension limits the elevation of the larynx, which is under muscle tension when swallowing. For this reason, more effort is needed to lower the epiglottis, which tightly closes the trachea and prevents part of the bolus from entering the trachea.

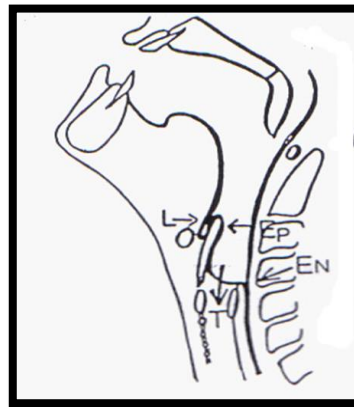
This candelabra-like posture may also cause pain or discomfort in the shoulder joints because the humeral heads are pushed forward.

The larynx is drawn down and backward, opening such that the trachea becomes an extension of the pharynx, which means that direct penetration or aspiration into the trachea may occur.

In addition, the terminal reservoir is inhibited by the larynx; the depressor muscles of the hyoid bone and the muscles of the floor of the mouth are very stretched; and the dilator muscles that descend the larynx are relaxed, which impedes the efficiency of laryngeal coughing and the swallowing reflex.

In the lower jaw, strong backward contractions retract the tongue and lift the upper lip. Contractions of the suprahyoid and infrahyoid muscles, of the upper pharyngeal obturators and of the tongue limit or impede forward and lateral movements of the jaw, thereby limiting swallowing.

There is also a peristaltic transport problem in the oropharynx and the lower pharynx because of the stretching of the muscles that descend from the jaw and the difficulty of bringing the dental arches together. The slightest delay in triggering the reflex causes direct penetration/aspiration. This means that the neck hyperextension requires extreme care because it allows penetration or direct aspiration into the trachea.



❖ Stretching maneuvers

The physical therapist intervenes to deal with the mentioned pathological postures in children with CP because they affect the orofacial musculature and the feeding process. Le Métayer explains that, before placing the child in a feeding position, stretching maneuvers need to be performed to appropriately position the child for feeding.

Stretching maneuvers are segmented exercises that enable local emphasis of the overall relaxed state. Contraction and relaxation enable the stimulation of adequate and adapted motor reactions to emerge. It must be remembered that the quality of the posture (i.e. how the child is positioned), greatly determines the quality of the control of the action, namely feeding in this case.

Once the child has been stretched, they are placed in a suitable posture that is safe for feeding. According to Le Métayer, there are three types of stretching maneuvers:

- Limb stretching: performed by progressively and gently stretching all the muscle groups that antagonise the contracted muscles.
- Weight shift: performed to reduce contractions of the muscles of a side of the body. In other words, if the weight is shifted to one side of the body, the opposite side relaxes.
- Pressure application: gradual, gentle pressure is used and can be applied to the third and fourth intercostal spaces. The pressure is applied downward and backward, which causes the trunk flexor muscles to contract, while the posterior extensor muscles of the spine relax.

The stretching maneuvers are performed as follows:



- Firstly, the lower limbs are stretched to put the child in a cross-legged position.
- Once the lower limbs have been stretched, a triple flexion (i.e. of the pelvis, knees and feet) is performed while flexing the child's trunk and head, maintaining support on the mastoid process.

- After that, the weight is shifted to pivot the child until they are held between the practitioner's legs. Remember that, to be able to feed a child, the therapist must also be well positioned, with the lower back and thoracic spine supported. Practitioners also use a knee to help to position the child's trunk at different degrees of inclination.
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- After curling the child up, keeping the torso and head bent, the pressure maneuvers can be performed on the third and fourth intercostal spaces, which allows the child's head to be bent and then positioned, in flexion, at a 30 to 40 degree angle in relation to their torso. It must be stressed that the chin should be tucked in, the torso should be inclined backward, and the gaze should be directed forward and down.

- The arms should be at the front, so that they can be relaxed. They can be placed in internal rotation.



- Lastly, note that positioning for child feeding is not limited to the mat or the floor; a moulded foam seat, a polypropylene seat or a plaster seat can also be used



- o Adequately positioning the child in a seat allows orthopedic care, keeps them in the correct sitting posture, and keeps them in a relaxed position.

Janeth mentioned that every therapist, before any attempt to help feed the child, must correct abnormal postures (principally neck extension), and check that a clear, strong, consistent swallowing reflex and an adequate cough reflex exist.

3. Speech and swallowing therapy

❖ Feeding

A basic life necessity, feeding is a process by means of which living beings consume different types of foods to receive all the necessary nutrients for their survival. It should be borne in mind that eating is much more than just gaining nourishment; it is a time when the family gathers to share ideas, thoughts and daily life activities and to strengthen familial and social bonds.



- Feeding disabled children



Willy said that, in a family with a disabled child, the child's difficulties are evident, and it becomes complicated to include the child in their surrounding and family. Often the mother feeds the child in another space because the dining area is not correctly adapted for the child to be part of the social circle around the table.

This is why parents' main objective is to be able to adequately feed and nourish their disabled child, reducing the risks that their condition involves.



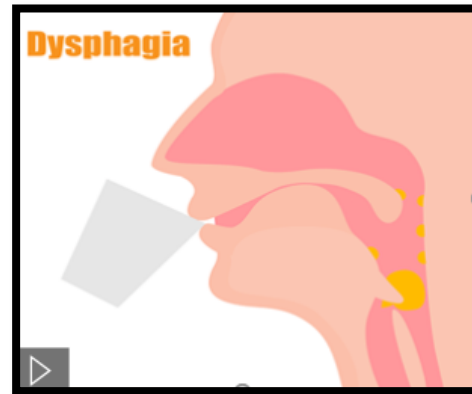
❖ Swallowing

A very complex neuromuscular process involving cerebral areas, cranial pairs and muscles, swallowing is the transport of food from the mouth to the stomach, without any difficulties such as choking, aspiration or penetration.

These swallowing difficulties are called dysphagia, and their presence in any swallowing phase creates problems that endanger the child's health. In children with infantile CP, dysphagia is called neurogenic dysphagia because it is caused by a disorder of the central or peripheral nervous system.

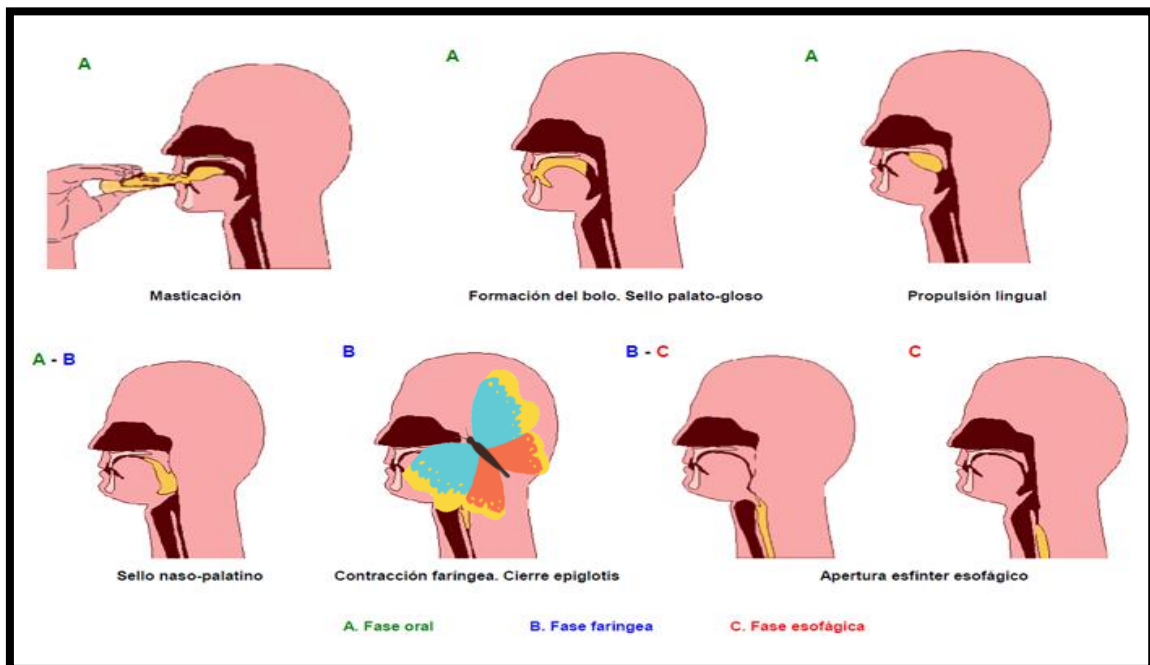
Neurogenic dysphagia can lead to further complications in any of the swallowing phases, such as:

- dehydration
- malnutrition
- pneumonias



❖ Swallowing phases

- **Oral preparation:** This comprises chewing (change of food consistency) and insalivation (physicochemical).
- **Oral phase:** The tongue pushes the bolus to the pharynx.
- **Pharyngeal phase:** Swallowing (mechanical) — the main process — consists of glottic closure, initiation of a peristaltic wave in the upper pharyngeal muscle, and opening the upper end of the oesophagus by relaxing it, allowing the bolus to pass.
- **Oesophageal phase:** A motor phase in which peristalsis and the primary and secondary esophageal peristaltic waves are activated.



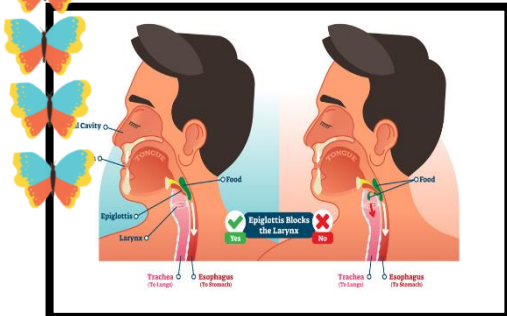
The first two phases are under cortical control. The presence of bolus in the oropharynx triggers the last two phases, which are under the autonomous control of a medullary center for swallowing, located in the brain stem. Neurological damage can affect any of these stages, depending on the type and location of the injury to the nervous subsystem.

Signs and symptoms associated with dysphagia



- **Sialorrhea:** The unintentional loss of saliva from the mouth, caused by:
 - o excessive saliva production
 - o poor lip control
 - o lack of lip closure due to muscular hypotony
 - o weak or flaccid orofacial musculature.

- **Delayed laryngeal elevation reflex :** No movement or slow movements, which complicates the correct entry of food.



- **Food penetration and aspiration:** When food remains on the vocal cords but does not enter the lungs, it is called food penetration. However, when the food remnant passes the vocal cords, goes down the respiratory tract and reaches the lungs, it is called aspiration, which can have complications such as pneumonia and even death.

- **Chewing with an open mouth:** The child has poor jaw control and does not perform the movements necessary to grind the food and form a bolus suitable for swallowing. As there is inadequate lip closure, some of the food ends up outside of the mouth, resulting in incorrect feeding.





Persistence of primitive reflexes: Primitive reflexes are all the reflexes present from birth until the respective ages of disappearance, which is part of the normal development of the human being. The reflexes related to feeding include the sucking reflex, the rooting reflex, the gag reflex, the bite reflex and the tongue thrust reflex. If these reflexes have not disappeared by the corresponding age, they become pathological reflexes and indicate a nervous system disorder. Their presence hinders the feeding process, specifically in changing the consistency of food.

The following recommendations should be taken into account when feeding a child with CP:

- **Types of food:** The appropriate consistency for the foods that the child can eat (liquids, soft foods, solid foods, etc.) should be evaluated and identified according to the child's abilities.



- **Suitable utensils:** The appropriate instruments for feeding should be evaluated and used because, depending on each child, the size may vary or adaptation may be needed; for example, a thicker spoon handle or an inclination (the occupational therapists will adapt the utensil). An appropriate glass should be used for fluid intake. It is advisable to use a small, elongate glass (similar to a shot glass), since this type of glass allows the amount of liquid, ingestion speed and lip closure to be controlled.

- **Time allocated to feeding:** Each child's condition must be considered. A child with CP requires a longer time to complete the feeding process properly, and feeding in this way allows the child to feel comfortable and unpressured, making eating pleasant.





- **Proper posture:** Stretching maneuvers must be performed before, during and after feeding, to prepare and safely feed the child.

❖ Brain motor rehabilitation of orofacial motor skills and chewing

Le Métayer recommends the therapeutic training of orofacial motor skills and chewing in children with infantile cerebral palsy, focusing on several compromised aspects:

- Sucking
- Taking food
- Retaining food and saliva in the mouth
- Chewing food
- Food bolus transport
- Swallowing difficulties

Several techniques are proposed for the training and rehabilitation of swallowing disorders in children with CP, including:

❖ Therapeutic training of chewing:

Appropriate techniques for spoon and glass handling need to be understood through a complete process.

- Solid foods

- Always look at the child face on, assess each step or response that the child makes, and position the child correctly.
- Hold the solid food firmly in a three-finger grip using the thumb, the middle finger and the index finger. These fingers will be used to move the food from one side to the other.
- Place the little finger under the chin to help to close the mouth.
- The ring finger supports the bottom lip and is used to aid lip closure.
- The food should be placed on the edges of the tongue to stimulate it to move and twist to form the food bolus.



- Spoon handling

- Spoon use is dependent on the child's motor skills.
- The child must be properly positioned.
- Use a spoon suitable for the size of the child's mouth. Whenever possible, it should have a rounded handle for ease of use by the feeder.
- The spoon should be held in a three-finger grip.
- Insert the spoon from the front and apply slight pressure to the tongue to trigger the closing of the mouth.
- When removing the spoon, rotate it laterally against the lips, so that all the food remains inside the mouth.



- Cup handling

- In the same way, the child must be placed in a suitable position.
- The cup should be long and made of clear glass so that the amount of liquid and the ingestion speed can be checked. It should have a narrow base and a rim suitable for the size of the child's mouth (shot glasses).
- The thumb and index finger should be positioned on the edges of the glass and are used to tilt the glass forward or backward.
- The little finger is placed under the chin.
- The ring and middle fingers support the lower lip.
- The glass always approaches from the front and downward to encourage the child to drink the liquid.

