DEVELOPMENT OF A TREATMENT MANUAL FOR ORAL DYSPHAGIA

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Registration number: 19SLP039

A dissertation Submitted in Part Fulfillment for the Degree of Masters of Science

(Speech-Language Pathology)

University of Mysore

Mysuru

ALL INDIA INSTITUTE OF SPEECH AND HEARING

Manasagangothri, Mysuru-570006

September 2021

CERTIFICATE

This is to certify that this dissertation entitled "**Development of a Treatment Manual for Oral Dysphagia**" is a bonafide work submitted in part fulfillment for the degree of Masters in Science (Speech-Language Pathology) of the student Registration Number: 19SLP039. This has been carried out under the guidance of the faculty of this institute and has not been submitted earlier to any other University for the award of any other Diploma or Degree.

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CERTIFICATE

This is to certify that this dissertation entitled **"Development of a Treatment Manual for Oral Dysphagia"** has been prepared under my supervision and guidance. It is also certified that this dissertation has not been submitted earlier to any other University for the award of any other Diploma or Degree.

Guide

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DECLARATION

This is to certify that this dissertation entitled **" Development of a Treatment Manual for Oral Dysphagia "** is the result of my own study under the guidance of Dr. Swapna N., Associate Professor, Department of Speech-Language Pathology, All India Institute of Speech and Hearing, Mysuru and has not been submitted earlier to any other University for the award of any other Diploma or Degree.

Mysuru **Registration No.: 19SLP039**

September 2021

ACKNOWLEDGEMENT

My sincere thanks to my guide ***Dr. Swapna N*** for guiding me all through the course of this dissertation.

I would like to thank the director ***Dr. M Pushpavathi*** for this opportunity.

The content validators for my manual have been professional and understanding in sharing their expertise with me, I am indebted for that. Thank you ***Ms. Prathima, Dr. Gayathri Krishnan and Ms. Nikita Kirane.***

Thank you ***Ranju, Rushali and Zainab*** for being my photographers and hand models, whenever I asked I couldn't have finished them on time without you'll...

There are many other people that I would like to thank.... hopefully I do justice,

First my batch mates, the ***Renovators,*** in some way or the other you people have made life at AIISH better for me, thank you!

My masters life was something that I would cherish throughout my life, all credits goes to my very special and crazy friends the ***Mamma Lllamass (Siddhi, Ranju, Aiza, Thiru, Rush, Zainab)....***You guys have always made me look at problems for the better!!!!

Jijinu, Christabel thank you for bearing with me whenever I came to your rooms yakking about my problems!

I would like to thank my dissertation partner ***Tanvi,*** well my friend in need, I knew I could always rely on you for anything. Thank you for making dissertation easier for me...

The last one month of my masters has been almost and always in library, I would like to thank my *library pals* for the in-between stress free talks....

All the love and patience that you showered me with throughout my masters knows no bounds, from the surprise parcels to consoling talks I can't describe enough. Thank you *Amma, Appa and Uvaang (U know I was gonna write this name)* for everything, you'll have stood rock solid to support me in every walk of life!!!

Thank you *Aiya* for your on-time calls, I really needed them...

Aatha, you have always been by my side and you still are....up above...watching me!! When I stress out, I close my eyes I feel your smile and all is ok....I hope I made you proud!!!

My love bug *Oyster*, I will always miss you, you have left me with a lot of positivity and got me out through the toughest times....Thank you!

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CHAPTER I

INTRODUCTION

Swallowing is a complex physiologic function that involves precisely coordinated movements within the oral cavity, pharynx, larynx, and esophagus (Shaw & Martino, 2013). Swallowing is broadly classified into oral, pharyngeal, and esophageal stages based on the location of the bolus (Matsuo & Palmer, 2008). Each phase of swallow is anatomically and physiologically defined (Sasegbon & Hamdy, 2017).

The oral phase of swallow is the first phase, which involves muscle of the lips, cheeks, tongue and mandible (Logemann, 1998). It involves mastication and manipulation of the bolus and transport of the same, finally leading to the pharyngeal phase of swallow. The oral stage has been further subdivided into oral preparatory and oral propulsive stages (Kuhlemeier, 1994).

The oral preparatory stage is initiated when the food or liquid is taken into the mouth. It is mixed with saliva to form a bolus. The formation of bolus takes place with the help of the lip, tongue and mandibular movements, after which food processing takes place through mastication and manipulation (Matsuo et al., 2013). In case of liquids the stage for bolus formation is skipped.

Once the bolus is formed from the above mechanism, it is then held by a groove formed by the tongue against the hard palate. After this, the propulsive stage of swallowing begins where through a wave like action initiated from the tongue tip and moving

posteriorly, the bolus is propelled in a squeeze-like action through the faucial pillars into the pharynx, marking the initiation of pharyngeal phase of swallow (Hennessy & Goldenberg, 2016).

The pharyngeal phase is involuntary and the shortest phase of swallowing lasting about 1 second. It is characterised by closure of the nasopharynx, vocal fold closure by the contraction of the lateral cricoarytenoids, elevation of the hyoid-laryngeal complex, opening the pharyngeal-esophageal transition and the inferior movement of the bolus through peristaltic contraction of the superior, middle and inferior pharyngeal constrictor. Finally the bolus is then transitioned into the upper esophageal sphincter.

The final phase is the esophageal phase, wherein a wave of peristalsis propagates the bolus inferiorly to the stomach through the lower esophageal sphincter. This involuntary phase is longer and lasts up to 3 to 4cm/s (Hennessy & Goldenberg, 2016).

A difficulty in any one or combination of above phases results in dysphagia. For example, a difficulty in the oral preparatory and oral propulsive phase in particular, results in oral dysphagia. When the food transport to the esophagus is affected, it leads to pharyngeal dysphagia. The causal factors varies from structural, systemic, psychogenic or neurological. The most widely attributed cause is neurogenic in nature like trauma resulting in neural damage or neurodegenerative disorders, stroke, tumours, etc. Systemic causes such as autoimmune diseases or viral infections results in oropharyngeal dysphagia. Oropharyngeal dysphagia is also said to occur more in individuals who have undergone radiation therapy and head and neck surgery for cancer (Carucci & Turner, 2015).

The prevalence of dysphagia ranges from 25 to 45% in typically developing and 33 to 80% in developmentally weaker children and 27% in premature infants (Krishnamurthy et al., 2020) and is one of the causes for aspiration pneumonia (Pavithran et al., 2018). In India, there is high incidence of dysphagia in stroke patients (11.1% - 87.5%) (Krishnamurthy et al., 2020). It is a major cause of mortality and morbidity due to the complications such as malnutrition and pneumonia and affect the quality of life (Stechmiller, 2003).

The most common symptoms of oropharyngeal dysphagia are difficulty holding food in the anterior portion of the mouth, difficulty manoeuvring food in the oral cavity, difficulty in bolus formation, pocketing of food in the anterior and lateral sulcus, difficulty chewing, difficulty producing saliva, difficulty in chewing the food and swallowing. Patients could also exhibit nasal regurgitation, coughing, choking, gurgle or wet voice after swallowing, unexplained weight loss, which result in complications such as respiratory infections and aspiration pneumonia.

Owing to the increased incidence of dysphagia, if ignored, it could lead to several complications such as pneumonia, weight loss and weaker immune system, poor emotional stability due to drastic changes in his/her quality of life. Hence it is highly essential to assess and initiate intervention at the earliest. Speech-language pathologists (SLPs) play a unique role in the assessment, diagnosis and management of dysphagia.

The aims of intervention for dysphagia depends on the type and nature of the dysphagia, the underlying cause, and the needs and preferences of the individual. The behavioural intervention strategies are broadly categorised into compensatory approaches and

rehabilitative approaches. Several authors published the behavioural approaches to oro-pharyngeal dysphagia. One of the first to review the treatment approaches in dysphagia was Langmore and Miller (1994). They stated that exercises for oral-stage problems was the subject of conversation until 1970's and the first article published on treating oro-pharyngeal dysphagia was by Larsen in 1972 (as cited in Logemann, 1991). Using the anecdotal presentations from him, several other authors developed facilitation techniques using occupational principles, like the active resistive exercises that includes blowing, puckering and smiling, use of quick ice, manual vibration for improving mobility and strengthening of lips. Further, techniques to improve functioning of lingual and buccal musculature was described.

Several evidence-based studies began to emerge. Logemann (1991) presented three ways to deal with oro-pharyngeal dysphagia, which included compensatory strategies, involving postural changes, changes with respect to the volume and consistency of the food, indirect therapy, which involved exercises without a bolus, resistance exercises for tongue and its coordination and chewing exercises, and direct therapy, which was mainly meant to change the physiology of swallow including oral-sensory manipulation and some manoeuvres.

Need for the study

Oral phase of swallow is the first phase in the process of swallow which will prepare the bolus for the transport through the pharynx and esophagus. Though oral-stage problems were the subject of focus since the beginning, a look into the existing literature revealed that with respect to oral dysphagia, there are limited treatment

manuals available with detailed description of step by step procedure supported by relevant pictures and videos are not available. A dysphagia rehabilitation manual was developed by (Akai, 2015), which includes rehabilitation methods as direct and indirect approaches such as postural management, however, there is no mention about the specific strategies to tackle the oral phase of swallowing. Another manual titled 'Management of Dysphagia in Acute Stroke: An Educational Manual for the Dysphagia Screening Professional' has been developed by Heart and Stroke Foundation of Ontario (Martino et al., 2006), however this addresses the needs of persons with dysphagia secondary to stroke and directed for the professionals who are involved in screening dysphagia such as the nurses. There are limited manuals that focus specifically on facilitatory strategies to improve the oral phase, which can be used across all disorders. The books by Groher and Crary (2015), Marks and Rainbow (2017), Ongkasuwan and Chiou (2018), Saitoh et al. (2017) and Ekberg (2012) include content on the intervention of dysphagia in adults and children, however these are not treatment manuals and do not include step by step description of procedure with appropriate illustrations.

An SLP has to be competent in treating patients with dysphagia and a treatment manual with the details of the procedures used, particularly for oral dysphagia may be beneficial. A treatment manual with details of what could go wrong in the oral phase and what needs to be done in case of a specific problem, will enable the SLPs to choose the right strategies for the management of oral dysphagia based on the underlying physiological impairment. This will also assist the SLP in the selection of appropriate treatment goals and devising an appropriate therapy plan for individuals with

dysphagia. Keeping this in view, the present study was planned with the aim of developing a manual for the management of oral dysphagia.

Objectives:

- To design and develop a treatment manual focusing on the rehabilitative strategies for persons with oral dysphagia
- To establish the content validity of the tool

CHAPTER II

REVIEW OF LITERATURE

Swallowing is a combination of voluntary acts and involuntary reflexes. Swallowing requires a very fine tuned and well-coordinated movement through the central nervous system and the respective muscles involved. Magendie gave the most conventional division of swallowing in 1825 (as cited in Marks & Rainbow, 2017), he proposed three phases of swallowing: Oral, pharyngeal phase and oesophageal phase. This classification is supposedly based on innervation, as oral phase is voluntary, pharyngeal is reflexive and oesophageal phase controlled dually by the somatic and the autonomic system.

The act of swallowing is complex and originates in the brainstem. Neural structures can be classified as being afferent level, efferent level and organisation level structures otherwise called the interneurons or premotor neurons. These interneurons in the brainstem that can organise and initiate swallowing pattern response are referred to as the swallowing Central Pattern Generator (CPG). Electrophysiological studies have revealed that these neurons are located in the nucleus tractus solitarus (NTS), the reticular formation surrounding NTS and reticular formation that is just above the nucleus ambiguous (NA) in medulla oblongata. These are grouped into dorsal swallowing groups and ventral swallowing groups respectively. These groups collectively shape, trigger and time the rhythmic swallowing pattern, excite the cranial nerve nuclei involved in swallowing and also distribute the swallowing drive to other motor neurons. This accounts for the involuntary swallow. When it comes to the

voluntary phase, it becomes clear that this medullary network described above has a cortical command from the simple fact that swallowing can be initiated on command. This command arises from several cortical structures such as the lateral precentral gyrus for initiation of swallowing and supplementary motor area for planning the sequential motor movements. Then the anterior cingulate cortex is initiated mainly during voluntary swallowing, the insula and frontal operculum involves sensori-motor integration therefor taste perception, the somatosensory cortex and posterior parietal cortex play a sensory role in swallowing and the temporal cortex plays a supplementary role in swallowing due to its role in taste and imagery of food (Dodds, Steward & Logemann, 1990; Mankekar, 2016).

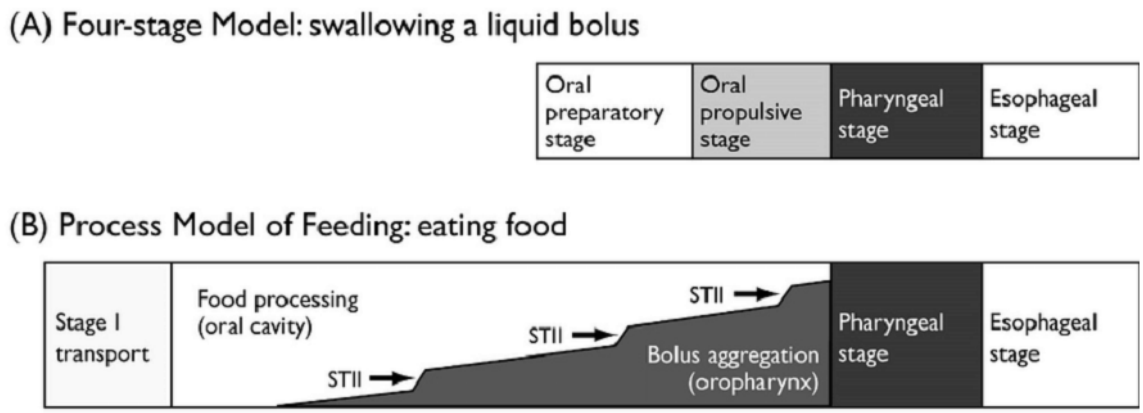
The process of eating, drinking and swallowing as discussed, is widely through the combined actions of the central nervous system and musculoskeletal system. Attempts to functionally understand this has lead to many physiological models for swallowing: the two stage model, the four stage model for liquid swallow, the process model for solid food and recently the two stage model (Saitoh et al., 2018). The more well accepted and recent models are the four stage model and the food processing model for chewing.

The four-stage model for liquids consists of oral preparatory, oral propulsive, pharyngeal and oesophageal stages. It explains swallowing on command, the spontaneous swallow in liquids and also accounts for the fact that bolus propulsion to pharynx begins only after the initiation of swallow onset. Once the liquid is taken in the mouth the oral preparatory phase begins. It is held between the anterior part of the floor of the mouth and the hard palate; the lips seal by the closure of the jaw. The contraction

of the buccinator prevents buccal pocketing, velum seals with the posterior part of the tongue to prevent premature spillage and secretion of saliva converts the food into bolus. Bolus is then propelled by the tongue movements. Breathing takes place in this phase, however any weakness to tongue or soft palate can lead to premature spillage. The oral propulsive phase begins when the tongue tip touches the alveolar ridge, the tongue keeps increasing the area of contact with the hard palate in an anterior to posterior direction and this squeezes the liquid into the oropharynx. When the bolus reaches the posterior part of the oral cavity, the velum contracts and seals the nasopharynx from oropharynx preventing nasal regurgitation. However, weakness to the palatine muscles can lead to nasal regurgitation. For liquids, the pharyngeal phase occurs along with oral propulsive phase (see figure 2.1).

Figure 2.1.

The four-stage model for liquid bolus and process model for chewing depicting the transport stages.



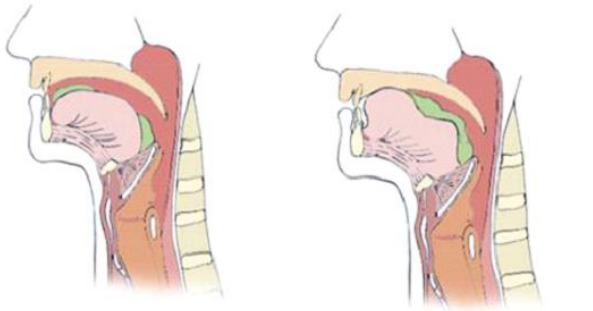
Note. From Textural Changes by Mastication and Proper Food Texture for Patients with Oropharyngeal Dysphagia, by K Matsuo and I Fujishima, 2020, (10.3390/nu12061613).

The basic difference between swallow in liquids and solids is the process of chewing, the food processing model accounts for this. It consists of stage I transport, the stage II transport along with food processing. The stage I involves tongue movements that carry the ingested food to the post-canine region, the tongue rotates laterally to place the food onto the occlusion surface of lower teeth for food processing. Here when the food is placed in the mouth it is moved from the surface of the tongue into the molar region in a backward pulling movement of the tongue called as the *pullback mechanism*. The food processing phase involves mixing of food with saliva, chewing to achieve proper consistency. The chewing takes place until all the food is processed. During this phase the movements of the tongue, velum and jaw move in cyclic manner keeping the food on the occlusional areas of lower teeth. An open passage is created between the oral cavity and the pharynx by the movement of the tongue and jaw to allow air to carry the aroma into the nasal chemoreceptors. It seems contrary to the oral preparatory stage in the four-stage model which involves sealing the posterior oral cavity from pharynx. Any weakness of the tongue, jaw, or cheek musculature can interfere with this stage. The stage II transport is active stage, similar to the oral propulsive given in the four-stage model. The anterior tongue contacts the hard palate just behind the upper incisors and continues to increase the area of contact between them squeezing the processed food to the oropharynx; the velum elevates to separate the nasopharynx from the oropharynx. So, when the food ready for swallow is chewed and moved from the tongue dorsum, propelled back from the oral cavity through the faucial pillars and to the oropharyngeal tongue surface in a squeezing

movement, it is called as the *squeeze back mechanism.* One point to be noted is that in stage II, transport occurs intermittently throughout the food processing; this way a portion of the food reaches the valleculae or the oropharyngeal region. So one can say food processing and stage II transport go hand in hand across time. The chewing behaviour of an individual also influences the timing of the food transport and initiation of swallow apart from the physiological time taken to complete the chewing. Early presence of bolus in oropharyngeal region increases the risk of aspiration. The oral phase has been depicted in figure 2.2.

Figure 2.2.

(a) The oral prepartory phase, as described in the process model for chewing: Stage II transport substantially occuring along with food processing stage. (b) The oral propulsive stage showing the squeeze back mechanism of the tongue.



Note. From "Heart and Stroke Rehabilitation – Canadian partnership for stroke recovery, by Iruthayarajah et al., 2018.

After the food reaches the oropharyngeal region, the pharyngeal phase of swallow is initiated. As in the four stage models for liquids it is known that the bolus propulsive

phase and the pharyngeal phase are initiated simultaneously. However, the order of the physiological events are redundant for both of the models. The pharyngeal phase involves a sequence of reflexive movements that primary is protection of airway and nasopharynx and passage of the bolus into the esophagus. The presence of food in the fauces initiates a sensory trigger that causes the velopharyngeal closure by the contraction of the levator veli palatini this also paves way for propulsion of bolus. Shortly after that the reflexive closure of the laryngeal inlet occurs. Initially the true and false vocal folds close, then hyoid bone and larynx are pulled upward and forward called the hyolaryngeal elevation, the tongue base covers the larynx and the epiglottis bends backward assumed to be due to the hyolaryngeal elevation, pharyngeal contraction or even the bolus movement. Because of all these events, a period of apnea occurs. The retraction of the tongue base pushes the bolus against the pharyngeal walls and sequential contraction of the pharyngeal muscles propels the bolus downward into the esophagus.

The oesophageal phase begins when the bolus enters esophagus. The Upper Esophageal Sphincter (UES) constantly is in a state of contraction; it opens up to allow the passage of bolus into the esophagus. Once the food passes the UES the smooth and striated muscles of the esophagus initiate a wave like peristaltic movement to move the bolus down the esophagus. The peristalsis that occurs at the thoracic esophagus is the true peristalsis that is regulated by the autonomic nervous system. The peristaltic wave consists of an initial wave relaxation that helps to accommodate the bolus followed by wave of contraction that propels the bolus down, along with gravity playing a role. During this phase, the velum lowers, hyolaryngeal elevation lowers, epiglottis resumes

its original position and laryngeal inlet opens for respiration. Once the food reaches the lower esophageal sphincter, it relaxes from its original contracted position to allow the bolus to pass through. This contracted state is maintained to prevent gastric reflux. Once the food reaches the stomach, the process of digestion begins. This sound knowledge on physiology of swallowing is what enables to classify dysphagia.

Dysphagia

Disruption in any one of the above-mentioned phases would result in dysphagia of that type. Dysphagia can be rooted in Greek as "dys" meaning disordered or difficulty and "phagia" meaning "to eat". One of the pioneer records in western medicine of dysphagia is traced back to studies done by Galenos in AD129-199, on anatomy and physiology of larynx. However, the evidences from traditional Chinese medicine show instances of dysphagia dating way back to 475 BC to AD 220. They even classify types like neurogenic dysphagia [Hou Bi] and oesophageal dysphagia [Ye Ge] (Feldmann, 2001). Other recognisable evidences surface during the 19th century; in 1800, Dr. Patrick Paterson reported a case of swallowing difficulty secondary to tissue death in the stomach. Dr. Armiger reposted a case of dysphagia after aortic aneurysm. The term "dysphagy" itself was first used by Nicolatopoulos in 1907 (Megna et al., 2012).

Research focused on identifying the pathophysiology and the probable treatment measures that can be taken up for it. In the late 20th century, rising incidence of dysphagia created a void for an easy, fast and economical method to assess swallowing. This was filled by the introduction of FEES in 1988, into the field (El Khoury et al., 2016). Dysphagia had become mainstream by the 20th century. Professionals began

developing therapy approaches appropriate to the cause and the exhibiting symptoms. Symptoms play an important role in determining the treatment approach. As it gives the origin, whether it is neurological, acquired or progressive. The cause also helps throw light on the regions that could be affected and eventually portraying the type of dysphagia.

Causes of dysphagia

Children and adults with dysphagia have variations in their etiology; for children the main cause could be due to traumatic brain injury, developmental disability, syndromic causes and post-surgical manifestations. For adults, the primary causes would be due to stroke, tumour, metabolic disorders, traumatic brain injuries, surgical resections and post-surgical manifestations. Broadly speaking, dysphagia can be associated with structural and functional causes. Structural causes include congenital conditions like cleft of lip and /or palate, tumours and surgical resection. Functional causes include factors of metabolic, myopathic or neurologic in origin.

Metabolic Causes: Chronic alcoholism, diabetes mellitus are some of metabolic causes of dysphagia. A study done by Borgstrom et al. in 1988 examined the effects of diabetes mellitus on swallowing using cine-radiography, which revealed that these individuals had dysfunction of pharyngeal musculature, laryngeal vestibule and also oesophageal motility, disregarding the severity of diabetes. Weber et al. in 1981 stated that chronic alcoholism leads to weakness of skeletal muscles including muscles of face, thereby causing difficulties in oral, pharyngeal and oesophageal phase of swallowing.

Myopathic Causes: Conditions such as polymyositis, myasthenia gravis, muscular dystrophies, metabolic myopathies such as thyroid myopathy and Kearns-Sayre syndrome are commonly associated with oral dysphagia, with increased oral transit time and increased time and effort taken for bolus mastication and manipulation widely seen. Due to the affected strength and tone of oral musculature, issues surface more during thin liquids than thicker consistencies. Muscular dystrophy is another condition that results in weakness of oral musculature leading to nasal regurgitation. It is a genetic condition characterised by autosomal dominant condition, leading to dysphagia. The incidence however varies with the type. Most of muscular dystrophies are associated with oesophageal dysphagia; however, a rare form of muscular dystrophy called "facioscapulohumeral muscular dystrophy" an autosomal dominant condition tend to surface oral phase swallowing symptoms also. Polymyositis is an inflammatory, connective tissue disorder that affects the proximal muscles initially and leads to atrophy and weakness of the muscles. However, the symptoms mostly arise at the pharyngeal phase of swallowing according to Prosiegel et al., 2017 (as cited in Marks and Rainbow, 2017)

Myasthenia gravis (MG), on the other hand is a known condition that affects swallowing, as muscle fatigue is the hallmark of this disorder. Colton-Hudson et al. in 2002 assessed the characteristics of dysphagia in MG. Clinical swallow assessment and video fluoroscopy of 20 patients with MG revealed that all patients did have mild flaccid dysarthria and dysphagia mainly in the oral preparatory, oral propulsive and the pharyngeal phase. In the oral preparatory phase, the patients had poor bolus formation with the tongue and extended chewing. The oral propulsive phase had residue at base

of tongue, poor retro- oral nasal seal, involving the soft palate and the posterior tongue. The pharyngeal phase included delayed hyo-laryngeal elevation and epiglottic deflection, reduced tongue base retraction and residue at the pyriform fossa and valleculae. Of the described, pharyngeal dysphagia was most common. In a surface electro-myographic study by Ertekin et al. in 1998, 15 patients evaluated were found to have delayed initiation if hyo-laryngeal elevation. Dysphagia in myasthenia gravis may occur as the sole symptom. Llabres et al., in 2005 indicates that mild to moderate dysphagia affecting the oesophageal phase mainly was the sole symptom of MG. Reduced and weakened peristaltic contractions of the smooth part of the esophagus in two out of three participants was revealed through oesophageal manometry. Moreover, single fibre EMG of the frontalis muscle showed impaired neural transmission. These symptoms were more evident and threatening in the geriatric population stated by Kluin et al., 1996 (as cited by Valls-Canals et al., 2003). Dysphagia in MG can occur even without symptoms. Umay et al. in 2018, grouped 36 participants with MG into two groups, one with dysphagia and other without dysphagia and compared them with group 3 controls. The results revealed that there was a significant difference between the MG group without dysphagia and the controls under the manometric, electrophysiological (EMG) and FEES tests. Dysphagia associated with MG also gives an insight on the predictive outcome of the disease, among 104 participants with MG were retrospectively assessed and grouped under the better outcome group or poor outcome group, 80 fell under the better outcome group and 24 fell under the poor outcome group. These 24 participants had significantly increased rate of dysphagia during the baseline than the better outcome group suggesting that dysphagia is a predictor for MG prognosis (Yoshimoto et al., 2021).

Neurological Causes: Neurological in its very word sounds very broad and there seems to be a lot of grey area as to what would and would not come under it. Some major causes include:

Neurodegenerative diseases: Conditions such as Parkinson, Amyotrophic Lateral Sclerosis (ALS), Multiple sclerosis, Alzheimer and poliomyelitis are mainly the disorders that influence swallowing. The manifestations in degenerative conditions would generally include gradual degradation in the time and speed of movement followed by deficits in tonicity.

Parkinson's disease (PD), as described by James Parkinson has associated dysphagia in its later stages. The symptoms progress from oral phase towards the pharyngeal and oesophageal phases. However, Ali et al. in 1996 stated that the main influence of dysphagia is at the pharyngeal phase and oesophageal phase involving restricted UES opening and incomplete UES relaxation. Evidences points towards oral phase being the predecessor and the patients would have lingual tremors, buccal retention greatly influencing the bolus mastication and the bolus propulsion. Suttrup et al. in 2015 describes the association of dysphagia with PD, the pathophysiology as stated by the authors is based on fMRI studies carried out previously, which showed that dopaminergic basal ganglia system involving the globus pallidus and putamen is activated during swallowing. So in an individual with PD, this dopaminergic reduction leads to swallowing difficulties. The patterns of Parkinson related dysphagia as stated includes tongue pumping, oral residue, premature spillage, piecemeal deglutition in the oral phase. The pharyngeal phase includes residue in valleculae and pyriform sinuses, aspiration and the oesophageal phase included spasms and multiple contractions. A

review by Patel et al. in 2020 concurred with Suttrup's claims adding more characteristics including xerostomia, sialorrhea, jaw rigidity, bolus containment deficits, poor lingual pressure generation and reduced spontaneous swallowing with respect to the oral phase of swallowing.

ALS is a progressive neuromuscular disease that involves the degeneration of motor neurons in the cortex, brainstem and spinal cord, this affects the nuclei if the IX, X and XII cranial nerves leading to speech and swallowing difficulties. The symptoms may manifest as dysarthria or dysphagia, and in the oral phase of swallowing as difficulties in bolus formation, transport and mastication resulting in residual pooling. Strand et al. in 1996 found that out of 140 patients with ALS, 76% had speech and swallowing in one-scale scores of each other, suggesting that speech and swallowing were affected to a similar extent by the bulbar degeneration. This is vital, as complaints of speech difficulties in these individuals would then indicate a rapid follow of swallowing deficits also. In order to look for the early stages of dysphagia in ALS, Kawai et al. in 2003 carried out video fluoroscopic and manometric studies on 11 patients and results revealed that in initial stages of ALS, dysphagia was prominent in the oral phase, characterised by reduces lingual movement and tongue atrophy. To dive deeper into the pathophysiology of this, Ertekin et al. in 2000 conducted a study with 43 individuals with sporadic ALS who were subjected to clinical and instrumental evaluation. As concurrent with previous study, the earlier symptoms of ALS begin at the oral phase, here the authors state that dysphagia in ALS is either difficulty in transportation of the bolus at the anterior part of the tongue or difficulty in holding the bolus at the posterior part of the tongue.

Multiple sclerosis (MS) is an inflammatory, autoimmune condition affecting the central nervous system (CNS). It is characterised by demyelination and gliosis formation (Solaro et al., 2013). As MS impairs structures like brainstem, corticobulbar tracts, cerebellum and the cranial nerves involved in swallowing, dysphagia also becomes a symptom. Poorjavad et al. in 2010, states that out of 101 patients with MS visiting the clinic across a span of one year, 28.7% had pharyngeal and oral stage disorders. Sensory neuropathy that occurs secondary to MS, results in pain, numbness in the intra-oral and extra oral regions (Covello et al., 2020), which affect the bolus mastication and formation of swallowing. Kovac et al. in 2005 stated that increased prevalence of TMJ (Temporo-Mandibular Joint) based disorders such as pain, difficulty in opening of mouth and neck pain is seen in individuals with MS. Another study by Covello et al. in 2020, stated that the oral health status is a crucial factor of overall quality of life in MS.

Alzheimer's disease (AD) is a neurodegenerative condition leading to the atrophy of the neurons resulting in loss of memory, affecting the social, cognitive and behavioural skills of the patient. The physiology involves formation of neurofibrillary tangles and amyloid plaques in the brain disrupting the neuronal connections in the brain. Sura et al. in 2012 stated that at least 45% of individuals with Alzheimer's disease have some form of swallowing difficulties. The severity however varies with the progression of the disease. In the later stages, the severity can go upto moderate level. Secil et al. in 2016 stated that swallowing difficulties is seen even in the early stage of AD. The severity progressed from being subclinical dysphagia to overt dysphagia and finally to swallow apraxia due to the severe cognitive impairment seen at that stage. With respect to the oral cavity, reduced intraoral sensory awareness leading to premature spillage

into the pharynx, increased duration of oral phase of swallow was also seen and more so in the later stages.

Poliomyelitis is yet another neurological disorder leading to dysphagia. Sonies et al. in 1991 examined the oropharyngeal and oesophageal musculature of 32 patients with post-poliomyelitis. The muscle atrophy was identified through clinical swallow examination, ultrasonography and video fluoroscopy. Signs like unilateral bolus transportation into pharynx, improper tongue control, pooling in valleculae and pyriform sinuses, delay in initiation of swallowing reflex and pharyngeal constriction and presence of oesophageal reflux, nasal reflux were found. Instrumental evaluation showed that there was an increased duration of swallow for both solids and liquids. More difficulty for liquids was noted. This difference was attributed to a delay in pharyngeal constriction and improper tongue control.

Stroke is the most common cause of dysphagia (Takizawa et al., 2016). More than 60% of individuals with acute stroke have dysphagia. The prognosis rate is less for brainstem stroke rather than hemispheric or cortical stroke. If there is a left cortical CVA, the effect is major on oral phase of swallow, affecting the range and initiation of movement during bolus intake, mastication and propulsion and sometimes swallow apraxia, whereas, brainstem lesions lead to a greater delay in the swallowing processes. A severe form of dysphagia is seen when there is a bilateral infarct to the fronto-parietal operculum mostly influencing the oral phase of swallowing, also called as the ‘Foix-Chavany-Marie syndrome’. Overall, the association between dysphagia and stroke is quite common in around 37 to 78% among stMartonoroke survivors (Martino et al., 2005).

Congenital conditions such as cerebral palsy also cause dysphagia. Depending upon the type, there are challenges seen with their timing, range, accuracy of movement. Spastic cerebral palsy exhibit difficulty in bolus mastication and intake initially and changing consistencies becomes challenging for the population.

Structural Causes: The major structural causes of dysphagia are tumours, surgical resection and congenital conditions.

Tumours: When it comes to cancer, dysphagia ought to be considered along the continuum, as dysphagia occurs due to the tumour itself, as a result of radiotherapy being given and due to surgical resections secondary to cancer. Tumours of the head and neck are the most common causes for dysphagia. Garcia-Martin et al. in 2019 compiled the epidemiology of head and neck cancer across the world and that the Indian subcontinent accounts for one third of total oral cancers in the world, with the largest incidence for cancer of lips and oral cavity. The risk of oral cancer globally is more in males than females and tends to increase across age. The same has been reported for the pediatric population (Arboleda et al., 2020). Carcinoma of tongue is the most common malignancy of oral cancers occurring in around 20% to 45%. India ranks the highest incidence globally not only for tongue, but also for mouth. The risk factors according to Singh et al, in 2019, can be due to lack of awareness, lower socio-economic status and improper health care facilities in India. However, with all this, the survival has also increased globally to a 50% (Garcia-Martin et al., 2019). Dysphagia in this population is very common and affects the quality of life.

Dysphagia - due to the tumour itself - this depends on the size of the tumour, the exact location and the pressure exerted to neighbouring structures. Tumours that are above T2 in the TNM classification present with swallowing difficulties. Their effect manifest as difficulty in speed and range of movement, beginning from the bolus intake until bolus propulsion depending on the site and size of lesion. Wesling et al. in 2003 gave outcomes of dysphagia in brain tumours both primary (directly originating in the brain) and secondary (spread from other parts of the body to the brain). The authors stated that dysphagia occurred in 26% of individuals with brain tumours and in case of primary tumour, the individual's complaints with dysphagia were a feeble representation of the actual impairment.

Dysphagia – Because of radiation and chemotherapy – there are obvious factors like the dosage, the method of treatment and volume of radiation that play a role. However, evidences indicate a gradual degradation of swallowing across time. The etiology of dysphagia secondary to chemotherapy is multifactorial: it can be due to infections, inflammation, fibrosis or any other neurological and muscular injury. Pizzorni et al. in 2014 stated the common symptoms associated with oral dysphagia as reduced mouth opening, poor lingual motion, poor bolus formation and transport, lengthened oral transit time and increased oral residue.

Surgical causes are yet another mechanical cause of dysphagia. Surgeries relating to dysphagia can be broadly of two natures: surgery to remove tumour or cancerous tissue and surgery to overcome a traumatic injury. The degree of swallowing impairment is determined by the anatomical resection, the size and area of removal. Glossectomy is one such surgery that majorly influences the oral phase of swallow. It can completely

hinder the mastication, preparation and propulsion of the bolus. Some tumours involving the pharynx and larynx and require removal of some tissue from tongue base, which lead to obvious reduction in bolus propulsion. According to Pizzorni et al. in 2014, partial glossectomy only involves altered oral control, clumsy movement of the tongue leading to altered lingual peristaltic movement. Anterior floor of mouth resections preserves swallowing with mild affect to oral control and mastication. Lateral floor of mouth resection affects the lingual propulsion and prolonged the oral transit time. Oropharyngeal tumours affects both the oral and pharyngeal phase of swallowing. Laryngectomy also influences the oral phase, as the removal of muscles like the hyoid elevators does influence the jaw opening and bolus transit time (McConnel et al., 1988). Neck based resections also have been noted to have presentation of dysphagia, due to probable removal of muscles and nerves involved in swallowing.

***Congenital conditions*:** Conditions like cleft of palate affect swallowing and feeding. Due to the affected teeth structure and palate, these individuals will find it difficult to masticate the bolus adequately and propel them to the pharynx. A cross-sectional between pre and post-surgery dysphagia symptoms in children with cleft lip and palate by Freitas et al., in 2018 revealed that these children exhibit major feeding difficulties, involving mastication, propulsion and nasal regurgitation. Moore and Rosenberg in 2018 stated that the dysphagia begins from infancy during feeding and progress across the child's developmental stages. It hinders with the child's weight gain and overall growth. Other such causes include dysphagia secondary to drugs such as corticosteroids, anticholinergic, neuroleptics, some antiretroviral drugs.

Anticholinergic drugs is known to cause dysphagia due to their effect to the central nervous system.

Management of dysphagia

With these vast and varied differences in the etiology of oral dysphagia, it becomes vital to assess the cause in order to provide targeted therapy approaches. The treatment of dysphagia will thus, depend on the cause and specific characteristics of the patient. Rehabilitation to dysphagia is ultimately to provide hydration and nutrition to the patient. The take on dysphagia treatment programs should be, a multidisciplinary approach and dynamic, as the course is not stagnant across time. The core members would include Speech Language Pathologist, Otolaryngologist, Neurologist, Dieticians, Dentist and Nursing staff.

There are different schools of thoughts for management of dysphagia. Over the broad horizon, one can say that there are behavioural therapy approaches, prosthetic approaches and surgical treatment methods. Surgical methods are taken up for structural deformities and correctable defects. Behavioural therapy approaches involve functional aspects like diet modification, posture management, compensatory manoeuvres and specific rehabilitative exercises. The role of a speech-language pathologist (SLP), in this context is eminent. According to American Speech and Hearing Association (ASHA) in the year 2000, the role of an SLP should be to identify and maintain the safety of swallow, implement objective assessment methods, to assess the oral motor structure and function, to determine safety feeding and food

consistencies, communication of the risk factors and therapy outcomes to the family members, and collaboration with the team.

Several authors have classified the behavioural therapy approach, being a broad term in itself. Logemann in 1998 gave a classification involving the use and no-use of food during the therapy, it was termed as direct and indirect therapy respectively. Direct therapy is working directly on swallowing using the food and following specific instructions, for example the 'supraglottic swallow'. The indirect therapy focuses on motor control without swallowing actual food, mainly recommended for clients with risk of aspiration and reduced oral intake. Murry and Carrau gave one of the more recent classification in 2006. The authors classified the behavioural approaches into compensatory and rehabilitative approaches. The author's interpretation for the same was in line with Logemann's claims. They attributed the compensatory exercises to indirect and rehabilitative to direct exercises. However, Swigert in the year 2009 differed from Logemann's ideas and provided another view, stating that compensatory strategies involve attempts to compensate for patients swallowing such as postural changes, consistency modification, changes in placement of food in the mouth while, the facilitatory strategies involves focusing on the muscle function and not involving the use of bolus. Ultimately, recommending a treatment approach would involve considering the timing of treatment, the recovery rate of the patient, the types of treatment whether it is environmental, active or passive.

Compensatory approaches

The postural management includes the modification of body postures to enhance swallowing (Marks & Rainbow, 2017). The most common postural strategies that improves swallowing function include the chin down posture, chin up posture, head turn to left or right and head tilt to left or right and lying down (Logemann et al., 2008). Another crucial compensatory approach is the diet modification. It becomes crucial during acute stages of dysphagia when transition to oral feeding begins. The diet modification decreases the risk of aspiration and provides required nutrition (Bach et al., 1989).

According to Crary in 2016, diet modification has sub components to it: Rheology, which includes the consistency of the food, adding commercial thickening agents for a slower bolus transit time and a cohesive bolus. In case of solids, pureed food to compromise for the mastication; volume – smaller bolus volume for better bolus control and safer transit, larger bolus volume for increased sensory awareness; temperature - cold temperature increases the awareness of the bolus and enhances swallow function; taste and Smell – tends to have a positive effect on the oral intake in a patient with dysphagia.

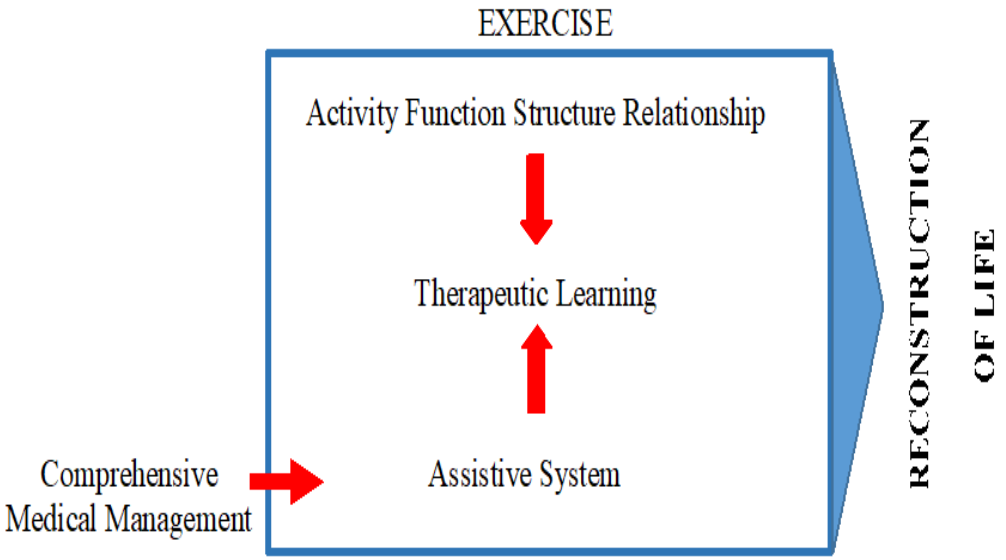
Facilitatory approaches

Facilitatory approaches broadly is stated as strategies that work on muscle function. The principles of motor learning play an important role in the facilitation of muscle function. According to Saitoh et al. in 2018, motor learning is the process of developing and maintaining motor performance, a series of processes that occur due to practise or

experience and result in long-term changes in competence. The systematic integration of the four methods is what helps in maintaining the function. The four methodologies include a comprehensive medical management, activity and function and structure relationship, therapeutic learning and the assistive system. The activity-function-structure relationship is the fine-tuning between the function and structure based on the posed activity level. This again brings back to the principle of motor learning, which means that disuse of muscle leads to deterioration, affecting the body function. Thus, early treatment with encouragement to the activity would give a upper hand on the functional ability. The integration and adaption between the four methodologies has been depicted in figure 2.3.

Figure 2.3.

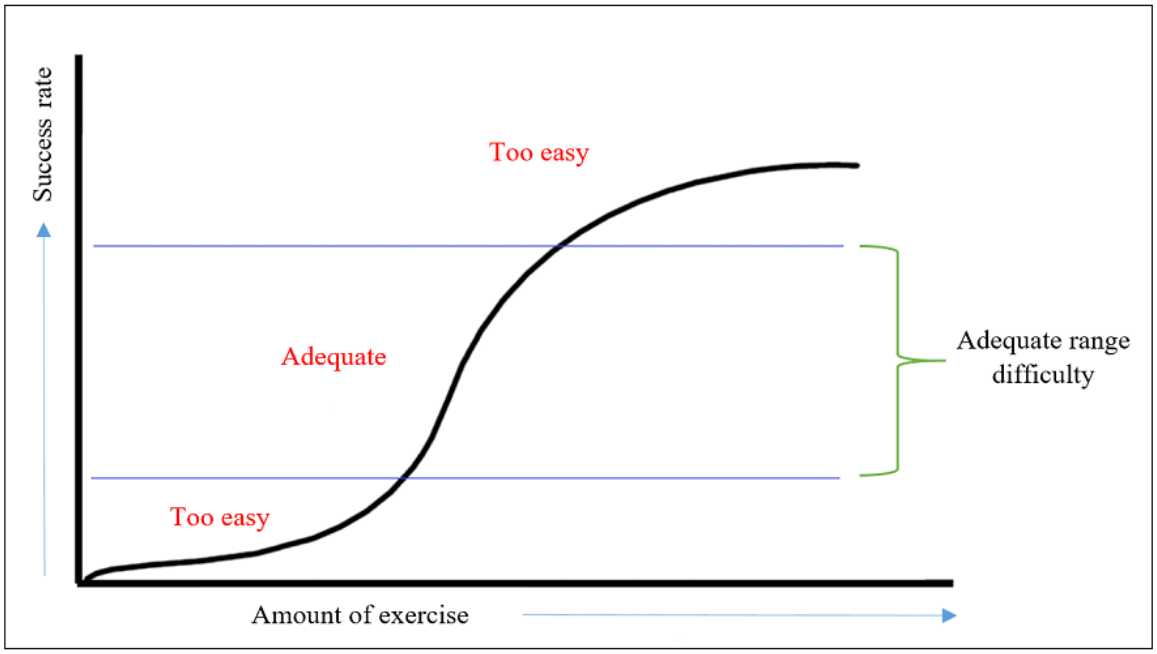
The four methodologies that comprise the core components of rehabilitative exercise.



Based on these principles, there can be two primary bases to classify the facilitatory exercises. The element-based exercises are based on the activity-function-structure relationship. This progresses in the order of tone management, passive and active stretching, mobility exercises, resistance-based exercises and sensory-motor integration exercises. These element-based exercises target the neuromotor control thereby improving swallow function. The behavioural exercises focuses on the principles of therapeutic learning. These exercises mainly focus on training with bolus using different textures. These exercises are learnt utilizing motor learning. Motor learning is a complicated process that occurs due to experience with a specific skill, resulting in changes in the central nervous system, thus, helping to develop a new skill. It is necessary for producing accurate and controlled movements and in calibrating reflexes. If we were to plot a curve for learning a skill through exercise based on the amount of exercise and the success rate then, it would be in in three phases: too difficult, adequate, too easy. This has been depicted in figure 2.4.

Figure 2.4.

Motor learning curve indicating the ability of the patient and the dosage of exercise

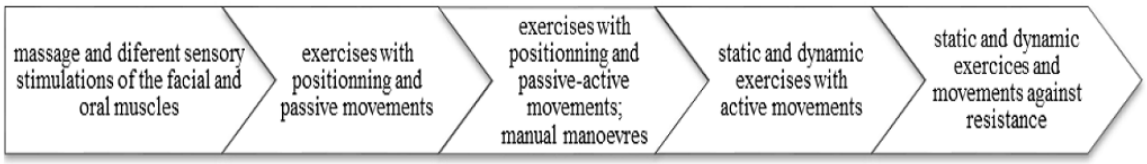


The concept of motor learning relies on four concepts according to Saitoh et al. in 2018, transferability (task specificity), that is the ability of the individual to transfer the training activity to achieving the ultimate desired function; Motivation (psychological driving force), that is, receiving reinforcement from either inner or external resources; Performance change (behavioural modification), that is acquiring motor abilities, which consists of three key components: *feedback*, which is made up of two components: knowledge of results and knowledge of performance, *quantity* meaning that a large number of repetitions are required for motor learning to be successful, and the *difficulty of exercise* which should be appropriate for the client's level to be transferred to the target. The last of the four concepts is retention/application. By increasing the variability and randomness of a task, the retention can be improved.

Another important regime of rehabilitative health care is evidence-based practice. It is very important for the clinician to know the evidence-based exercises, especially when concerning dysphagia. There are fair amount of evidences that indicate the importance and efficiency of facilitatory approaches for oral dysphagia. The non-speech oro motor exercises have been reported to be effective for the management of oral dysphagia. The crucial points of tone management include analysing the variation of tone in the oral facial musculature than the limbs. The initial records of oral motor function is attributed to speech mechanism. Boyadzhieva-Deleva in 2020 classified the order of progression of exercises for oral dysphagia, which has been depicted in figure 2.5.

Figure 2.5.

The sequence of application of non-speech oral motor exercises for oral dysphagia.



Note. From Contemporary classification of non-speech oral motor exercises, by Boyadzhieva and Deleva in 2020. (https://ikm.mk/ojs/index.php/KIJ/article/view/4619)

Tone management of oral dysphagia consists of stretches, massage and sensory stimulation. The tonicity of a muscle is the resistance offered to a passive stretch or palpitation. During a passive stretch, the fibres lengthen and stimulate the muscle spindles, the sensory receptors synapse with the lower motor neuron (LMN) leading to the muscle stretch. The main strategies of massage include stroking, rubbing, crushing and vibration. The place of application can be intra and extra oral in nature. These passive movements help facilitate swallow and voice production (Boyadzhieva-

Deleva, 2020). Massage and stretching can be useful in reducing the muscle spasticity according to Gangale et al. 1996 (as cited in Bakheit, 1996). An EMG study carried out by Hwang et al. in 2004 on 3 individuals with spastic dysarthria examined the effect of massage and oral exercises for increased lip function. The treatment involved massage to the upper lips, buccal area and also massage to the jaw. The results revealed a higher post test score for diadokinsesis and decreased RMS (Root Mean Square) values that indicates improved muscle tone. Functionally, improved tone of the lips prevents anterior spillage and facilitates a better swallow.

Sensory stimulation is done with touch, taste, texture and/or temperature stimuli. Thermal-tactile stimulation using cold stimuli on the anterior faucial pillars has been used commonly to trigger the pharyngeal swallow. Rosenbek et al. (1996) used cold stimulation for reduced tone seen in the bolus propulsion phase of 24 post stroke individuals with dysphagia. The exercise involved the use of cold stimulation to the faucial pillars for a duration of 10 minutes. The exercise was carried out for a duration of 4 weeks. The results revealed a reduced oral transit time and faster oral to pharyngeal stage transition. Hwang et al. (2007) conducted an experimental study on 33 participants with dysphagia post intubation. The oral muscle tone was managed using thermo tactile stimulation, oral stimulation, massage and range of motion exercises. Significant difference was found in the oral transit time, oropharyngeal transit time and oral pharyngeal swallow efficiency compared to the control group who received only oral hygiene measures. Clark in the year 2003, summarises the generally used methods for hyper or hypo tonicity respectively. This has been depicted in table 2.1.

Table 2.1

Tone management strategies for hypertonicity and hypotonicity

Deficit	Treatment approaches
Disrupted tone – Hypertonicity	Passive exercises – Slow stretch and deep massage. Modalities like cold stimulation and vibration.
Disrupted tone – Hypotonicity	Passive exercises - Tapping, Quick stretch. Modalities like cold stimulation, vibration and electrical stimulation. Active exercises – Strength training, power training

Note. From Neuromuscular treatment for speech and swallowing, by M Clark, 2003, (https://doi.org/10.1044/1058-0360(2003/086).

However, the use of tapping, stretches and vibration for lingual and lip muscles is effective only to a limited extent due to the variation in the physiology of their muscle function (Clark et al., 2005; Kisner & Colby, 1996). The lingual and lip muscles lack stretch reflexes as they have no muscle spindles. The dense muscle spindles are seen only in the jaw musculature, which makes them ideal for stretching.

Working on strength becomes the progressive step after tone management. Clark also summarises strength, range of motion and resistance-based exercises for oral dysphagia

in particular. Clark emphasized that in case of hypotonicity, there is reduced strength and endurance in the muscles and hence strength training, power and endurance training are essential. There are various strength parameters considered; force or intensity – progressing intensity increases strength, maximum intensity shows the best changes in terms of strength rather than endurance; Speed and rate – the exercise speed should match the speed of the desired movement outcome; Duration - increased duration of exercise increases stretch and endurance; Dynamics – states the relationship between muscle length and tension. Isometric contraction tension increases while length is constant and length increases while tension is constant in isotonic contraction. Frequency includes the number of training sessions that are scheduled. Progression includes the systematic increase in velocity of contraction, resistance build up (Clark, 2003). The strength-based exercises can be applied on the lingual-labial musculature and the mandible.

Logemann et al. (1998) carried out a study on 102 participants with post stroke dysphagia; the rehabilitation approach included range of motion and strengthening exercises for lips, tongue and jaw. The results revealed a significant difference in the oral swallowing efficiency and oral transit time for both liquids as well as pureed food.

Isometric lingual strengthening exercises such as using air-filled bulb to press against the palate improved the lingual strength. This ultimately improved the quality of life measures and improved the dietary intake in the 10 patients post stroke patients according to the study by Robbins et al. in 2008. Similar results were observed by Burkhead et al. in 2007. Caudell et al. in 2009 took up lingual resistance-based exercises using a spoon or a tongue depressor for 30 patients with head and neck cancer before

chemotherapy. The exercise included 10 repetitions and five times per day. The results revealed a significant increase in the functional oral intake scores and posterior base of tongue retraction between the baseline and after the exercise program.

Lazarus et al. (2014) carried out lingual strengthening exercises in head and neck cancer patients for a duration of six weeks. The exercise involved pressing the tongue against the palate as hard as they can for 2 seconds. Measures like oropharyngeal swallowing efficiency scores and tongue strength showed significant difference in the pre and post test scores. Similar exercise regime was carried out by Park et al. in 2015 on post stroke patients with dysphagia and significant difference in scores were seen in maximum tongue pressure of Iowa Oral pressure Instrument (IOPI) between the pre and post therapy measurements. Rogus-Pulia et al. in 2016 took older adults with multiple etiologies to dysphagia, in intensive care and carried out an IOPI based tongue strengthening regime. The results revealed significant higher anterior and posterior lingual pressures and reduced oropharyngeal residue.

Moon et al. (2018) took up 16 sub-acute post stroke patients with dysphagia and carried out isometric tongue strengthening exercises, which involved tongue press against resistance using the IOPI on anterior and posterior portions of the tongue. The duration of therapy lasted for 8 weeks. The results revealed a significant difference between pre and post treatment in the IOPI scores on the anterior and posterior isometric lingual pressure and also in the quality of life measures. Yano et al. in 2019 observed a significant increase in the lingual pressure both at the anterior and posterior portion from the first until the third month of training in 30 neurotypical individuals. The IOPI was used in this study.

Lingual exercises like ‘pushing the tongue against the palate and swallow as you squeeze the neck muscles’ was carried out by Park et al., in 2019 on 27 stroke patients and the pressure between the tongue and the palate was monitored by the IOPI. Significantly higher scores on the anterior and posterior tongue strength and the overall oral phase of swallowing became evident. According to Park et al., 2019, isometric and isotonic tongue strengthening exercises on 30 young healthy adults revealed a significant increase in the thickness of the mylohyoid and digastric muscles. The training was given for 6 weeks with the isometric exercise of the tongue being a 10 second hold and the isotonic exercise lasting for 2 seconds.

In a review by Langmore and Pisegna in the year 2015, the authors state that with respect to strength and resistance, the major evidence is present with respect to the lingual exercises. Mckenna et al. (2017) reviewed the isometric tongue strengthening in adults with and without dysphagia. Out of the 10 studies taken up, 4 were random controlled trials. Almost all the studies involved pressing of tongue against the palate with air bulb in between; the placements were from anterior until posterior. All the studies revealed a significant difference in the IOPI resistance scores. Similar evidences are seen even in children exhibiting feeding issues.

The efficacy of jaw strengthening exercises have been assessed several researchers. Wada et al. (2012) carried out jaw opening exercises on patients with reduced Upper Esophageal (UES) opening. The exercise involved opening the jaw as much they can and holding onto the same position for 10 seconds. The exercises were carried out for 4 weeks. The results not only revealed a significantly increased UES opening, but also reduced oropharyngeal residue and better hyoid movement. Kraaijenga et al. in 2015,

took up 16 healthy older subjects and subjected to a jaw strengthening program involving chin tuck against resistance and jaw opening exercises against resistance. Exercises included pressing the bar towards the chin and holding for 30 seconds. This was followed for 6 weeks. The results revealed a significant increase in chin tuck strength, jaw opening strength, anterior and posterior tongue strength and also increased muscle volume for the jaw. Therabite exercises hold similar physiology of passive jaw stretch. Retel et al. (2015) examined the efficacy of Therabite in 15 head and neck cancer patients receiving chemotherapy, and measured the improvement using the quality of life measures. The exercise program involved the use of Therabite for graded jaw opening for 4 weeks. The results revealed that jaw mobilization using Therabite served as a preventive swallowing exercise in these individuals ultimately improving the quality of life measures.

Chewing exercises greatly improve the mastication event of the oral phase of swallow. Kawazoe et al. in 1982 examined the effect of chewing exercises on masticatory function in seven patients with progressive muscular dystrophy. The exercise involved three main exercises for the mandible. In the first exercise, the patients had to clench their jaws as hard as possible after vibration for 5 minutes at 110Hz, applied to the center of both the masseters while maintaining a medium jaw contraction. In the second exercise, the patients had to open widely and clench the jaw with flexion and extension of the neck, respectively. Head is rotated and the mandible moves to the contralateral side, which is repeated five times. In the third exercise, the patients had to depress and elevate the tongue with flexion and extension of the neck, respectively. Head is rotated

and the tongue moves to the contralateral side, which is repeated five times. The results revealed improved muscle function between pre and post recording sessions.

Grandi et al. in the year 2007 carried out a study on 18 head and neck cancer patients receiving chemotherapy or radiotherapy with oral dysphagia. The exercises were a home based program involving range of motion exercises for the jaw and strengthening exercise using gum carried out for 10 repetitions in a session 6 times in a day. This course took place across the duration of chemotherapy or radiotherapy. Results revealed a physiological improvement in the jaw opening between the baseline and after the exercise based program. (as cited in Molen et al., 2010)

Hagg et al. (2008) carried out lip muscle training involving pulling oral screen with closed lips on 10 patients with dysphagia, post stroke. The exercise involved pulling with resistance to lips for 5 to 10 seconds, 3 times per day, for a total of 5 to 8 weeks. The results revealed a significant increase in the lip force. A study by Hagg et al., in the year 2009, retrospectively studied 30 patients with oropharyngeal dysphagia and their progress in lip function using the oral screen. The treatment protocol included use of oral screen between the lips and teeth and pulling using the loop for around 5 to 10 seconds. The exercise regime was carried out for 5 weeks. The results revealed a significant difference between the pre and post-test measures in the lip force measurement and the swallow capacity test. Takamoto et al. (2018) carried out another lip based exercise on healthy elder adults. The training involved holding the lips closed for a duration of 3 minutes. The training period was for 4 weeks and the results revealed that there was significant difference in the eating behaviour. The ability to hold mouthful bolus and rate to complete mouthful improved. Recent studies provide focus

to the use of oral screen for lip seal and strengthening; the functioning of the oral screen shares the same principle as the button pull technique.

There are several authors who take up an eclectic platform for oral dysphagia, inculcating the best possible options for patient care. Elmstahl et al. in 1999, took up 38 post stroke patients with dysphagia and oral motor exercises were carried out to work on range of motion and resistance based exercises along with swallowing manoeuvres for pharyngeal phase. Around 60% patients exhibited improved swallowing function after the treatment. A similar study by Denk et al. in 1999 revealed increased oral intake (as cited by Speyer et al., 2010).

In a review by Speyer et al. in 2010, several studies among the 59 studies taken up revealed that oral motor exercises had a positive effect on the oral intake and swallowing efficiency. Strength and range of motion exercises have also been evidenced to initiate cortical reorganisation in brain-damaged patients (Hamdy et al., 2000). Arvedson et al. in the year 2010, reviewed the effect of oral motor intervention in feeding and swallowing skills in preterm infants. The review included 12 studies, which addressed the effect of oral motor intervention on swallowing physiology, functional outcomes in feeding and swallowing. Positive outcomes were seen with respect to physiology, and in oral feeding. The study revealed that the effect of sensori motor therapy was approximately 15% above the effects of maturation.

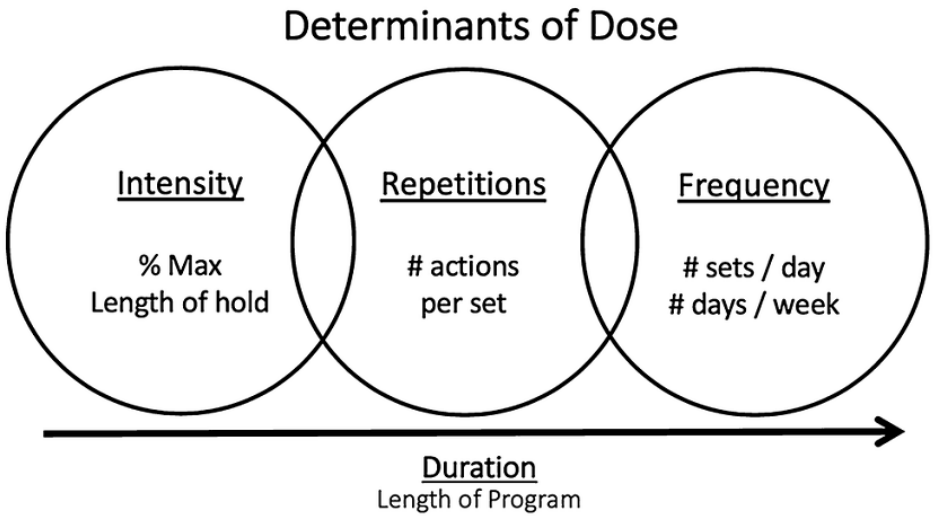
Coker-Bolt et al. in 2013 examined the effect oral motor stimulation for feeding and swallowing in 18 infants with congenital heart disease. The exercise involved oral stimulation for once a day, 6 days a week. Children receiving the oral motor stimulation

improved drastically in feeding ability and were able to do full bottle feeds 2 days earlier than their control peers. A significant difference was seen in the number of days of hospital stay between the control and the experimental group.

The amount of dosage recommended for every population would be determined keeping the above factors in mind also. Krekeler et al. in 2021 reviewed the dosage for exercise-based intervention in dysphagia. The study included 72 articles involving dosage for facilitatory exercises concerning the mandible, tongue, lips and larynx. Various dosage protocols are given. However, it comes down to three main determinants as shown in figure 2.6.

Figure 2.6.

The three main determinants of dosage for exercise based intervention in dysphagia.



Note. From Dose in exercise-based dysphagia therapies: a scoping review, by Krekeler et al., 2020, (https://doi.org/10.1007/s00455-020-10104-3)

The clinician should be discrete in being able to select the correct exercise, dosage, the muscle to be addressed. It is evident from the literature that it also depends upon the patient, the disease or disorder of interest and the impact of quality of life of the patient. It is also clear from the stated evidences that behavioural intervention is an essential component of dysphagia intervention. Even so, there is a lack of sufficient information and training material available to address the need, particularly in case of oral dysphagia. In this context, this study was planned with the aim of developing a resource manual for the treatment of oral dysphagia.

CHAPTER III

METHOD

The aim of the study was to develop an easy to comprehend and user-friendly manual in English for speech-language pathologists, that would help them when dealing with individuals who have oral dysphagia. The development and validation of the manual was taken up in two phases.

PHASE I: Development of the manual

The content of the manual was compiled from various sources including books, journals such as Google scholar, PubMed, ASHA wire, Core, Wiley, JSTOR, Thieme journals, online write ups and resource manuals and so on. The literature search was focused towards oral dysphagia in particular and the various evidence-based approaches that are available for its treatment. Among the treatment approaches, the facilitatory approaches was the focus and hence more emphasis was given to compiling these approaches. Other complimentary materials including the photographs and pictures were also collated to form the manual.

The literature gathered was compiled under four chapters as described below.

Chapter I: This chapter included information on the basic physiology of swallowing, particularly the oral phase of swallow. Swallowing being a complex activity, it is important for the clinician to have a knowledge on the sequence of events that are involved in swallowing in order to clinically correlate and make appropriate decisions. Pictures and tables were included for better understanding.

Chapter II: The second chapter focuses on the possible causes of dysphagia and its impact on the oral phase of swallow.

Chapter III: This chapter being the core of the manual, consists of exercises to treat oral dysphagia, written in simple steps. The exercises are supported by pictures that facilitates easy comprehension. The pictures depict demonstration of the exercise. This chapter was further categorized into five subsections that address specifics of the topic. Each of these subsections are divided into activities that address the underlying impairment and the activities that facilitate eating and drinking. The following are the subsections:

1. Bolus placement difficulties
2. Bolus containment or retention deficits
3. Bolus formation or manipulation deficits
4. Bolus mastication deficits
5. Bolus propulsion deficits

The manual also is attached with worksheets that help track the performance and prognosis of the client. (Appendix C)

Chapter IV: Maintenance of oral hygiene is another regime under the oral dysphagia rehabilitation. The role of an SLP here would involve timely referrals to dentist and counselling on maintenance of oral hygiene. The contents of this chapter provides this information.

PHASE II – Content Validation of the Manual

The manual was provided to three speech-language pathologists who were experienced in the field of dysphagia and were established professionals, dealing with oral dysphagia and rehabilitation on a daily basis. The third chapter which contained the exercises were provided for validation. The feedback was obtained for both the pictures and the written content. The parameters for rating were adapted from the 'Feedback questionnaire for Aphasia Treatment Manual' in MANAT- K developed by Goswami et al., in the year 2010. The validation involved rating parameters on a three-point rating scale, with the lowest rating being 0 – poor and highest being 2 – good. The initial questionnaire consisted of 15 parameters such as simplicity, accessibility, relevancy, iconicity, scope of practice, feasibility, volume and so on. The parameters that were used for the rating, however varied between the pictures and written material. For the written material, the following parameters were included:

1. Relevancy
2. Simplicity
3. Arrangement
4. Accessibility

For pictures, the following were the parameters included:

1. Size of the picture
2. Colour and appearance
3. Arrangement of the picture
4. Relevance

The judges were asked to rate based on the parameters. A sample form used for content validation is attached in Appendix A. The exercise or picture that was rated by more than 50% of the judges as poor was removed from the manual. The validated manual is attached in Appendix B.

CHAPTER IV

RESULTS

The study aimed to develop a manual for the management of oral dysphagia. The results of the study have been presented under different sections below.

4.1 Development of the manual

The manual was developed by compiling information relevant to the management of oral dysphagia from various sources including books, journals such as Google scholar, PubMed, ASHA wire, Core, Wiley, JSTOR, Thieme journals, online write ups and resource manuals and so on. The literature gathered was compiled as four chapters. The chapter I included information on the basic physiology of swallowing, particularly the oral phase of swallow. The second chapter focused on the possible causes of dysphagia and its impact on the oral phase of swallow. The third chapter being the core of the manual, consisted of exercises to treat oral dysphagia, supplemented with pictures which depict the demonstration of the exercise. This chapter was further categorized into five subsections that address specifics of the topic. Each of these subsections are divided into activities that address the underlying impairment (without the use of the bolus) and the activities that facilitate eating and drinking (with the use of the bolus). The following are the subsections:

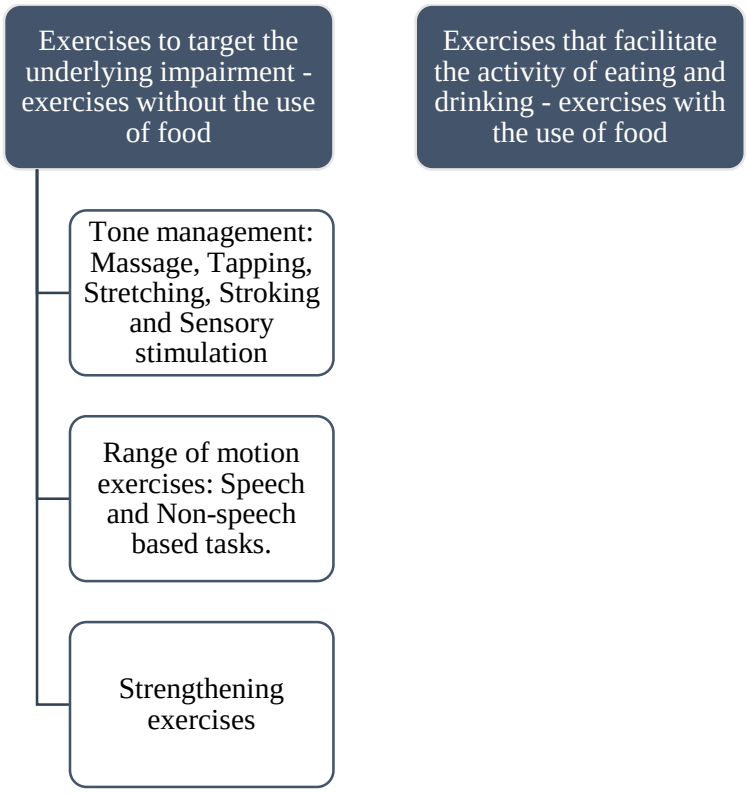
- Bolus placement difficulties
- Bolus containment or retention deficits
- Bolus formation or manipulation deficits

- Bolus mastication deficits
- Bolus propulsion deficits

The figure below depicts the progression of content under each subsection in this chapter of the manual.

Figure.4.1

The flowchart used for progression of content throughout the third chapter of manual



The contents of the chapter III that were collated under each of the subsections have been described below:

I. Bolus placement exercises: The exercises focused on the lips and jaw broadly.

1. Exercises that targeted the underlying impairment included tone management, range of motion exercises.

a) Tone management

- Massage: The exercises focused on massage to the masseter and temporalis muscle, followed by massage to the lips.
- Sensory stimulation: The exercises here focused on stimulation of the jaw and lips.
- Slow stretching: Exercises that reduce tone for the jaw were compiled under this section.
- Other exercises: Neck exercises that indirectly work on jaw opening were complied. For example: bending head, tilting head and so on.

***b) Range of motion exercises*:** These exercises have been categorised into speech and non-speech tasks.

- Exercises involving non-speech tasks: Range of motion exercises such as assisted jaw opening, independent jaw opening, jaw lateralisation were included. The exercises complied under this section were physiologically either active or passive exercises.
- Speech based exercises: The exercises involved production of phonemes, CV syllables and combination that would elicit a jaw movement. Word list for the same is provided.

2. Exercises that focus on eating and drinking included activities that focused on graded jaw and lip opening during cup placement and spoon feeding. Exercises that focused on graded jaw and lip opening for placement of a liquid and solid bolus was included.

II. Bolus containment and retention exercises: The exercises complied under this section focused on the lips and jaw as these are the major structures involved in this phase.

1. Exercise focusing on the underlying impairment included tone management, range of motion exercises and strengthening exercises.

a) Tone management

- Tapping: Exercises that work on tapping of the jaw muscles were compiled.
- Quick stretching: Quick stretching exercises for only the jaw was included under this section. These exercises focussed on increasing the tone of the jaw muscles.
- Quick stroking: Stroking exercises for the jaw followed by the lips were included.
- Sensory stimulation: Cold stimulation for the jaw and lip muscles were incorporated in this section.

b) Range of motion exercises

- Non speech tasks: Included activities for the jaw and lip retraction, protrusion, lip press, puffing up of cheeks, whistling, blowing exercises and so on.
- Speech based tasks: Exercises here focused on use of sounds, syllables and words that facilitated the maximal movement of the lips..

c) Strengthening exercises

This included exercises for both the upper and lower lips. Some of them included holding increasing weights between lips, cross bar pull, upper and lower lip against resistance using tongue depressor, button and thread pull exercise and so on.

2. Eating and drinking based exercises included activities such as sucking using a lollipop and slurping. Exercises for the containment of a liquid and solid bolus is also included.

III. Bolus formation and manipulation exercises: Exercises for the mobility and strength of the lingual musculature was compiled under this section.

1. Exercises highlighting the underlying the impairment included tone management, exercises for range of motion and strengthening exercises.

a) Tone management

- Quick stroking: Comprised exercises that involved stroking of the tongue using ice cream stick, cotton swab and toothete.
- Sensory stimulation: Exercises involving temperature and pressure stimulation, cold and sour stimulation to the lingual musculature, stimulation using different textures of food was compiled under this category. Exercise for intraoral stimulation of cheeks was also included as the tonicity of cheeks is also crucial for proper manipulation of the bolus.

b) Range of motion exercises

- Non speech exercises: Passive exercises for tongue lateralisation, protrusion, elevation, retraction of tongue were taken up. Exercises like sliding of tongue, curling, sweeping across the palate were all incorporated under this subsection.
- Speech based exercises: Production of syllable combination that increased the tongue mobility was the focus here. Exercises involving production of syllables like /t/, /d/ and other palatal and trill sounds were also included.

c) Strengthening exercises

Exercises including tongue push ups, push downs, tongue depressor against resistance, holding tongue on cheek and so on were compiled.

2. Exercises for activity of eating and drinking included the following activities like lingual sweep with a solid bolus, candy manipulation, manipulation of gauze for a liquid bolus and solid bolus were some of the exercises included under this subsection.

IV. Bolus mastication exercises: The focus of exercises here was to improve tone and mobility of the mandible.

1. The exercises for the underlying impairment included the following:

a) Tone management

- Tapping: Tapping exercises for the masticatory muscles were included
- Quick stretch: The jaw exercises that helped increase the tone using stretching was compiled here.
- Quick stroking: Stroking exercises for the jaw muscles was compiled in this subsection.
- Sensory stimulation: Cold stimulation exercise for the mandible was included.

b) Range of motion exercises

- Non speech tasks: Tasks like breathing with closed mouth for a better jaw closure, munching were included.

c) Strengthening tasks

Exercises such as biting down against ice cream stick bundle, jaw opening against resistance, jaw lateralisation against resistance were included here.

2. Eating and drinking based exercises for bolus mastication included munching candy, chewing on gum, chewing in gauze bag and so on.

V. Bolus propulsion exercises: Exercises compiled under this section focused mainly on the mobility and coordination of the tongue, along the anterior, middle and posterior regions. Exercises for stimulation of the velum was also included.

1. Exercises for the underlying impairment of bolus propulsion included:

a) Tone management

- Massage: Exercises to stimulate and increase blood flow to the anterior, middle and posterior portion of the tongue was included.
- Stroking: Exercises in anterior, posterior and lateral direction of the tongue was focused here.
- Sensory stimulation: Cold stimulation exercise for the soft palate was included under this subsection.

b) Range of motion exercises

- Non speech exercises: sucking of tongue against palate, backward tongue elevation, tongue sweep, back of tongue retraction were some of the exercises that were compiled under non-speech tasks. Activities like yawn, gargle were also included.
- Speech tasks: Included use of words and syllables that elicited a better posterior tongue movement such as velar sounds /k/, /g/.

c) Strengthening exercises

Exercises that worked on the strength of the tongue particularly the posterior portion was focused and incorporated under this section.

2. Exercises for the activity of eating and drinking included propulsion using a sour bolus, posterior propulsion of a gauze bag with bolus and so on.

Finally, the fourth chapter included the information on maintenance of oral hygiene.

4.2 Content validation of the manual

The third chapter which contained the exercises were provided for validation to three SLPs who were experienced in rehabilitating individuals with dysphagia on a daily basis. The validation involved rating parameters on a three-point rating scale, with the lowest rating being 0 – poor and highest being 2 – good. Validation for both the written content as well as suggestions for pictures were taken up. The exercise or picture that was rated by more than 50% of the judges as poor was removed from the manual. They also provided suggestions towards improvement of the manual. Some of the suggestions were incorporated.

The following were the suggestions by the judges, changes incorporated and justification for the same.

4.2.1: Written content validation

The following table shows the rating for the four parameters provided by all the experts for the written content of the manual.

Table 4.1

Responses provided by all the three judges across parameters for the written content

Chapter No.	**Simplicity**			**Relevancy**			**Arrangement**			**Accessibility**		
	P	**F**	**G**	**P**	**F**	**G**	**P**	**F**	**G**	**P**	**F**	**G**
Chapter III	-	-	3	-	-	3	-	3	-	-	-	3

Note. ***P:*** Poor, ***F:*** *Fair,* ***G:*** *Good.*

It can be seen that the parameters of simplicity, relevancy and accessibility were rated as good by all the three validators. However, the parameter of arrangement was rated as fair by all the three of them. The experts also provided some suggestions provided to improve the arrangement which have been depicted in the table below. Some of the suggestions were incorporated, while the others were not incorporated. The details of this along with the rationale has also been provided in the table.

Table 4.2

Suggestion obtained from the experts and the changes incorporated

Suggestion	Changes incorporated
Include a simple checklist in the initial section so that the clinician can decide which all pages to refer in the manual.	Use of checklist to identify a deficit in any one event of the oral phase of swallowing would be futile because there is always an overlap in the possible deficits that can affect the specific event in the oral phase. Hence this suggestion could not be incorporated.
Requires uniform arrangement based on increasing complexity	This suggestion was taken up and the concerned modifications were made. The hierarchy was arranged based on increasing complexity of the exercises. The following were the changes made with respect to hierarchy: • Exercises of jaw were arranged prior to the lip exercises.

	• Exercises involving bolus was arranged from easier to challenging consistencies, like use of soft food before progressing to harder food items. • Exercises involving materials like spoons, balloons were arranged based on progressing complexity. For example, balloons with increased diameter were recommended to be used before smaller diameters. • Lip press exercises were shifted before the lip press- lip retraction exercise, under the bolus retention and containment subsection.
Suggestion to include materials required for every exercise.	This suggestion was considered. All the exercises that involved materials, even if it was just a pair of gloves, were included.
Providing additional notes and disclaimer wherever required. Lip exercises involving upper lip, also should include lower lip	The suggestion was considered. Instructions for exercising the lower lip is also necessary and hence added.
Use of non-hollow chewy tubes for jaw strengthening exercises.	This suggestion was taken up. Non-hollow chewy tubes provide more resistance than hollow chewy tubes and hence included.

Detailing the direction of muscle movement for tone management based exercises.	More specification into the direction of massage, stretching or stimulation would help the clinician administer the exercises accurately and hence this modification was made
Detailing on the making of cross bar is needed	It is important to have a simple yet detailed explanation on making of a cross bar for lip exercises, therefore additional explanation was provided.
Content can be arranged in order of complexity.	The suggestion was considered. For example, using hierarchy to arrange the chewy tubes, beginning with red and then yellow.

Apart from the above, rephrasing of some complex sentences were also undertaken. A few general comments from the experts were as shown below.

- A range of exercises has been extensively covered in simple language.
- The manual is user friendly for clinicians attempting to rehabilitate individuals with dysphagia.
- Use of pictures in the manual help guide clinicians for better execution of the exercises.

4.2.2: Validation of pictures

The manual included a total of 53 pictures demonstrating the exercises and also materials required wherever necessary. However some figures required a sequence within them, thus making a total of 84 images. Likert scale scoring used for the rating by the judges was the same as that for the written content, with the highest score being 2 indicating ‘good’ and lowest being 0 indicating ‘poor’.

Table 4.3

Responses provided by all the three judges across parameters for the pictures

Overall scoring of the figures	**Size of the picture**			**Colour and appearance**			**Arrangement of the picture**			**Relevancy**		
	G	**F**	**P**	**G**	**F**	**P**	**G**	**F**	**P**	**G**	**F**	**P**
Judge 1	84	0	0	82	2	0	70	13	1	35	31	18
Judge 2	84	0	0	76	8	0	84	0	0	84	0	0
Judge 3	70	14	0	73	11	0	79	5	0	80	4	0
Overall percentage of scoring	94.44 %	5.56 %	-	91.67 %	8.33 %	-	92.46 %	7.14 %	0.39 %	78.96 %	13.89 %	7.14 %

Note: G: Good, F: Fair, P: Poor

It can be seen from the table that for the parameter on size of the picture, 238 pictures (94.44%) were rated as good, 14 pictures (5.56%) were rated as fair and none were rated as poor. For the parameter on colour and appearance, 231 pictures (91.67%) were rated as good, 21 images (8.33%) were rated as fair and none were rated as poor. For

the parameter on arrangement of picture, 233 pictures (92.46%) were rated as good, 18 pictures (7.14%) as fair and 1picture (0.39%) as poor. On the relevancy parameter, 199 pictures (78.96%) were rated as good, 35 pictures (13.89%) as fair and 18 pictures (7.14%) as poor.

The images that were rated as fair and poor were modified as per the suggestions or replaced with acceptable images. No images were removed from the manual, as none of the images received the rating of ‘poor’ by more than 50% rating of the judges. The following table summarizes the figures that were modified:

Table 4.4

List of figures that were modified based on the suggestions provided by the judges.

Figure No.	Suggestions	Modifications made
Figure 3.6	Lower lip movement not shown	Addition of another image showing the direction of movement for lower lip
Figure 3.26	Placement of spoon appears incorrect.	Placement of spoon depicted as being received by the lips alone.
Figure 3.30	Picture does not depict the correct execution of the exercise	The image was replaced with an appropriate image of 'O' posture of the mouth.
Figure 3.44	Picture does not depict the correct execution of the exercise.	The image was replaced with a more appropriate image demonstrating the intake of gauze dipped in liquid by the lips.
Figure 3.46	Arrows could be added	Arrows to indicate the 'C' direction of stimulation to cheek was done.

Apart from the above, suggestions to add more pictures were also given by the judges. This was taken up if atleast two of the judges agreed upon adding another image to the same exercise. The following were the images that were included in the manual.

Table 4.5

List of figures that were added after validation of manual.

Figure number	Exercise
Figure 3.21	Independent jaw retraction and protrusion
Figure 3.22	Independent lower jaw opening with tongue elevation
Figure 3.48	Combined retraction and protrusion
Figure 3.49	Tongue lateralization outside the mouth
Figure 3.50	Tongue movement in lateral and anterior sulcus
Figure 3.58	Masako manoeuvre

To summarise, the outcome of the study was a manual for the management of oral dysphagia, which was validated for its contents. The results have been discussed in the next chapter.

The following were that changes were incorporated in terms both content and images under each of the domains:

Bolus placement: specification of direction of movement during tone management exercises were made. Detailing on notes regarding the direction of massage and temperature stimulation was made and instructions for direction of movement in lower lip exercise was done. Hierarchical arrangement of chewy tubes, addition of non-chewy tube for jaw strengthening Detailing on the progression for lip opening exercise was another change. With respect to pictures, two additional pictures figure 3.21 and figure 3.22 and modification on spoon placement in figure 3.26 were included under this domain.

Bolus retention and containment: Instruction for lower lip exercises under stroking was detailed. Detailed and simple instructions were better included for the crossbar push exercise. In regard to pictures, modification in figure 3.30 was done to indicate the correct posture and 3.44 to justify the written content of the exercise.

Bolus formulation and manipulation: Additional instructions for use of cold temperature in sensory stimulation was provided. Pictures were also modified such as, 3.46 arrows were included to indicate the direction of movement. Additional pictures, figure 3.48, figure 3.49 and figure 3.50 were provided for better representation of the exercises.

Bolus mastication: Detailing in the use of gauze bag for mastication exercises involving solid bolus.

Bolus propulsion: Use of simpler sentence in tongue against palate exercises for easier understanding. Figure 3.58 added to provide a better understanding of the masako manoeuvre.

CHAPTER V

DISCUSSION

The outcome of this study was to develop a treatment manual for oral dysphagia, which included a total four chapters. The manual was validated for its contents by three experts experienced in the area of dysphagia. The first chapter of the manual included a brief introduction to the physiology of swallowing, elaborating more on the oral phase. This was included to provide the speech-language pathologists (SLPs) or clinicians with a brief overview on the physiology of the oral phase of swallow. The second chapter complied content on how the events in the oral phase of swallow are affected due to different causes so that the clinician is aware of the possible consequences on swallowing due to different disorders. The third chapter was the core of the manual, which consisted of five subsections on bolus placement, bolus retention and containment, bolus formation and manipulation, bolus mastication and bolus propulsion. Each of the subsections included exercises to improve the underlying impairment and activity without and with bolus. The contents under each subsection are classified based on studies done by Clarke et al. (2003) and Boyadzhieva and Deleva in 2020.These exercises were supported with additional pictures for better reference. The last chapter consisted of simple points that an SLP needs to keep in mind with respect to oral hygiene. It is important to have a sound knowledge on oral hygiene for overall health of individual and for preventing aspiration pneumonia in individuals with dysphagia.

This manual finds its uniqueness in being able to serve as a common source for oral dysphagia irrespective of the etiology; it is applicable to a post stroke patient with dysphagia, post-chemotherapy dysphagia, dysphagia secondary to traumatic brain injury and so on. This manual focusses on targeting the underlying impairment by addressing body structure and function and the corresponding activity of eating and drinking, which is in accordance with the ICF model approved for use by WHO in 2001. Further, both speech and non-speech tasks have been included in the manual. This is because the physiological functioning of articulators for swallowing or chewing and in production of speech is similar, although strength between the tasks may vary (Watson et al., 2008). Moreover, the use of speech tasks would work additionally on better articulation if it is affected in a patient.

A look into the literature revealed that there are manuals for rehabilitation of individuals with dysphagia. “Dysphagia rehabilitation” by the Canadian heart and stroke foundation is a manual which includes the pathophysiology, assessment, and intervention of swallowing problems in post-stroke dysphagia. Though the intervention strategies included here focuses on both oral and pharyngeal dysphagia, the content is not extensive under oral dysphagia and includes just a few exercises for tongue strengthening. In contrast to the same, the manual developed in the current study extensively provides information on the management of oral dysphagia, specifically the facilitatory approaches, irrespective of the underlying etiology.

Another manual by Akai in the year 2015, provided details for rehabilitation of dysphagia. Developed as a collaborative activity with WHO, this manual also is solely attributed to dysphagia. This includes activities for oral and pharyngeal phase as well,

irrespective of etiology. The manual deals with rehabilitation in broader sense, including both compensatory and facilitatory exercises. As a result, it falls short in being able to provide a detailed information on the facilitatory exercises. This manual has also not been field tested yet. In contrast, the present manual focuses specifically on the facilitatory approaches for oral dysphagia. It classifies the oral phase into five major events and provides exercises addressing each of these events with pictures wherever necessary. The manual after revision from content validation is provided as an Appendix B. The manual has been rated to have good content validity. This would thus serve as a suitable material for rehabilitating individuals with oral dysphagia.

CHAPTER VI

SUMMARY AND CONCLUSION

Dysphagia is the difficulty in swallowing, which can occur in any of the three phases of swallowing. Oral dysphagia is when an individual has difficulty in feeding, chewing or sipping food involving all textures. With the vast etiology, the effect to oral phase will vary in severity and prognosis. The need for a manual to guide the clinician on taking up facilitatory exercises for oral dysphagia is urgent with increasing incidence and prevalence, the resources available for the same is ironically less. The manual should be able to improve the quality of life in the patient by rehabilitating them. A look into the existing literature revealed limited treatment manuals with a detailed description of the exercises to be carried out in the event of oral dysphagia supported with pictures. This narrows to the aim of the study. The purpose of the study was to develop a manual that serves as a resource for treatment of oral dysphagia using facilitatory approaches.

The research developed was a non-experimental, exploratory study. The development of the manual began with a review of literature in search of journals, webpages, electronic databases, books and other manuals for treatment of dysphagia. The collected information was collated under four main chapters to form the manual. The first chapter provided a brief introduction about the physiological events in swallowing. The second chapter oriented the reader on the various causes for oral dysphagia and their effect on the events of oral phase. The third chapter, consisted of five subsections wherein exercises for oral dysphagia were described. The five subsections reflected the events

that take place within the oral phase of swallowing which is bolus placement, bolus containment and retention, bolus manipulation and formulation, bolus mastication and bolus propulsion. Each of these subsections included exercises that targeted the underlying impairment without the use of the bolus and exercises that targeted the activity of eating and drinking with the use of the bolus. that were supported with pictures wherever necessary. The fourth chapter of the manual included information on the role of an SLP in maintaining oral hygiene for a patient with oral dysphagia.

To validate the written content and the pictures, these were given to three Speech-Language Pathologists. With respect to the written content, some changes were made in the arrangement as the judges had rated that parameter as fair. The exercises were arranged in the increasing order of complexity. They all opined that the manual was user friendly and a useful tool clinically for patients with oral dysphagia. Other suggestions involving addition and alterations to some pictures, as some of the pictures were rated as fair. The revised manual was then compiled and finalised.

The manual will help the clinician in carrying out facilitatory strategies in a stepwise manner and also increase the quality of service delivery. The step-by-step exercises and supported pictures in the manual will help with accurate execution of the exercise. This manual is applicable for the pediatric and adult population.

Videos are audio-visual content and offers a multisensory advantage. Video referencing for oral motor exercises, particularly would be beneficial, as it would enable real time execution of the exercises. It would help for a better and easier understanding of the direction and manner of movement required, the direction of massage, stretching etc.

Such videos could have been prepared for the exercises included under the manual. However due to shortage of time, the same could not be prepared, which is a limitation in this study. Further, field testing could not be taken up due to the COVID-19 pandemic, which is another limitation of the study. Hence the validation of the manual on clients with oral dysphagia and the development of supporting videos can be taken up in the future.

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APPENDIX

APPENDIX A - Content validation format

From,
Yaazhini O D
II MSc Speech Language Pathology
All India Institute of Speech and Hearing
Mysuru
570006

To,
****
Through the Guide
Sub: Expert opinion for content validation of the manual-reg.

Respected Sir/Madam,

I am a second year student in MSc Speech language pathology at All India Institute of Speech and Hearing, Mysuru. The topic for my dissertation is "Development of a treatment manual for oral dysphagia" under the guidance of Dr. Swapna N, Associate Professor of Speech Pathology, AIISH, Mysuru. In connection with this I have developed the treatment manual for clinicians working with dysphagia. The manual contains basic anatomy, probable causes, simple steps to carrying out an exercise for oral dysphagia and oral care from a speech language pathologist point of view. The objective of the manual is to provide the clinician with a guide in facilitatory exercises for oral dysphagia. As a part of content validation of this manual, I request you to kindly provide your expert opinion. Specifically for the chapter titled "Strategies for oral dysphagia". Enclosed below is the content of the manual and the rating format. I would like you to kindly guide me with your valuable suggestions regarding the content in the space provided.

Thanking you in advance,

Yours Sincerely,

Yaazhini O D

II MSc SLP

VALIDATION CRITERIA CHECKLIST

Kindly provide your rating and remarks based on the following parameters:

Simplicity	If the language used simple and easy to understand.
Relevancy	If the content is relevant to the topic of the study
Arrangement	If the provided content is arranged in an orderly manner
Accessibility	If the content given is user friendly for the clinician.
Appropriateness of the picture	If the given pictures are appropriately given based on the content.

0- Poor, 1- Fair, 2- Good,

VALIDATION FOR THE WRITTEN CONTENT

Chapter III	Simplicity	Relevancy	Arrangement	Accessibility	REMARKS
Strategies to reduce oral dysphagia					

0- Poor, 1- Fair, 2- Good,

VALIDATION FOR PICTURES

	Size of the picture	Colour and appearance	Arrangement of the picture	Relevance	REMARKS
Chapter III: Strategies to reduce oral dysphagia					
Figure numbers					

APPENDIX B – Revised and Validated Manual

TREATMENT MANUAL FOR ORAL DYSPHAGIA

INTRODUCTION

We all know what is dysphagia, its causes and its types, but when it comes to rehabilitating these individuals, we tend to fall short on a detailed material that helps us understand the effects of dysphagia and the specific strategies and techniques to be implemented. This is more so for oral dysphagia, as there are very few manuals that describe the therapy for oral dysphagia. This manual finds its advantage in being able to provide a treatment manual that focuses only on the oral phase of dysphagia.

The manual progresses in four chapters:

1. Oral dysphagia-Events and structures: This chapter familiarises the reader anatomical and physiological events of swallowing in general and the events specific to oral phase of swallow, the knowledge of which contributes to more efficient assessment and management of oral dysphagia.
2. Oral dysphagia and its impact: This chapter focuses on the probable causes of oral dysphagia and their effects on the events of the oral phase of swallowing.
3. Strategies to reduce oral dysphagia: This chapter comprises of the crucial aspect of the manual; it contains the facilitatory exercises and techniques carried out for individuals with oral dysphagia. There are five sections for the exercises, based on the different events seen in the oral phase of swallowing. They are:
    a) Bolus placement difficulties
    b) Bolus containment or retention deficits
    c) Bolus mastication deficits
    d) Bolus formation or manipulation deficits
    e) Bolus propulsion deficits

    The exercises are ordered under activities for targeting the underlying impairment and under activities addressing eating and drinking.

4. Oral hygiene and its maintenance: This chapter highlights the importance of oral hygiene and the role of an SLP in ensuring oral hygiene.

CHAPTER I

ORAL DYSPHAGIA – EVENTS AND STRUCTURES

Understanding the anatomy and physiological events of swallowing and feeding is imperative for assessment and management of the same. This chapter focuses on the swallowing process as a whole, with a greater emphasis on the oral phase of swallow, since this manual focuses on the strategies to overcome oral dysphagia.

The process of swallowing involves the movement of food from the mouth (oral cavity) to the stomach though the pharynx and esophagus. It is an essential and complex behaviour, learned very early in development. Swallowing is orchestrated by a combination of cortical, subcortical and bulbar structures (Vose et al., 2018), which results in the coordinated movement of several muscles in the aero-digestive tract. Over thirty muscles and six nerves produce this coordinated movement (Matsuo & Palmer, 2008).

Earlier swallowing was seen to generally progress in three stages; oral, pharyngeal and oesophageal (Magendie, 1836). However, later research established swallowing as a process occurring in four stages by subdividing the oral phase into oral preparatory and propulsive stages (Logemann, 1984;1998). Swallowing is partly a voluntary and partly a reflexive activity. The oral phase is volitional, while the pharyngeal and esophageal phases are involuntary. For the swallow to be normal, the anatomic structures must be intact and their functions must be appropriately timed sequence with each other, which requires the integrity of the motor and sensory nervous system. Let us look into the structures involved and the physiological events that occur during swallowing in a little more detail.

Oral phase

The oral phase, which includes the oral preparatory phase and the propulsive phase, primarily occurs in the oral cavity. The oral cavity is responsible for gathering foods and liquids and preparing them for further transit to the stomach. The two important aspects of the oral phase include chewing the food and mixing it with saliva (oral

preparatory phase) and then advancing the bolus into the posterior oral cavity (oral propulsive phase). These events occur sequentially, i.e., as mastication is completed and then the bolus is transported.

Oral preparatory phase: The lips, teeth, cheek, alveolar ridge, tongue and the mandible are all involved in this phase to position the food and grind it. This phase involves placing the food on the tongue, mixing it with saliva and forming it into a bolus. Initially when the food is placed on the anterior portion of the tongue, it is moved laterally to between the molars, where it can be chewed. The lateral movement of the tongue is essential to move the bolus between molars. Moreover, during the placement of the food on the tongue, the lips close which, prevents anterior spillage. Specifically, the buccinators and orbicularis oris muscles help to seal the lips and keep the food without spilling out of the mouth. The food mixes with saliva and a bolus is formed, for which the rotary action of the tongue and the mandible are essential. In case of a bolus such as a biscuit or banana, this requires biting into the food or tearing the food, which is performed by the upper and lower incisors and canines. Adequate tone in the lip and cheek muscles prevents the material from lodging into the anterior and lateral sulci. The velum is pulled anteriorly (lowers) and makes contact with the back of the tongue to prevent material from prematurely spilling into the pharynx prior to a swallow. In case of liquids, the bolus is held with the tongue, as it forms a cupped position against the anterior portion of the hard palate (tipper position), or it is held on the floor of the mouth in front of the tongue (dipper position). Moreover, in case of liquids, mastication is not required before a swallow. The events that occur, the structures involved and the function in the oral preparatory phase are depicted in the table 1.1 below.

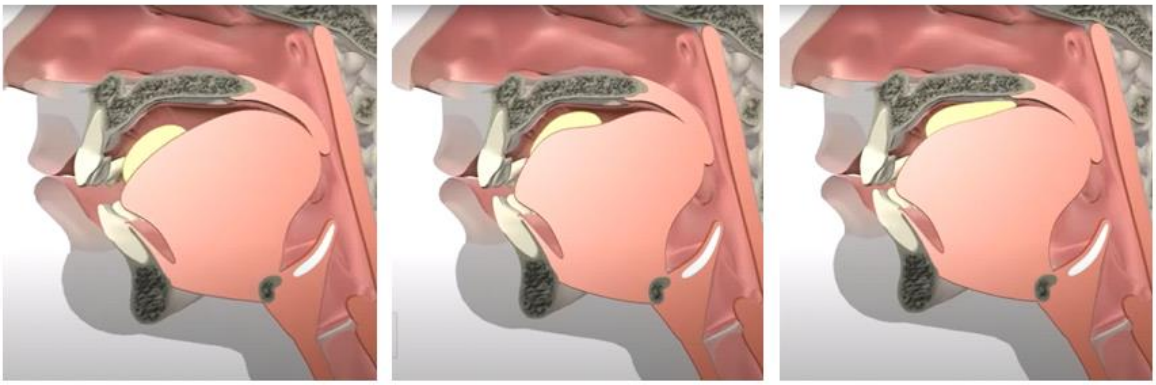
Table 1.1:

Events in the oral preparatory phase with the structures involved and their function

Event	Structures involved	Function	End result
Food placement (solid/liquid placed in the mouth)	Lip, tongue and jaw	• Jaw opens and then closes after placement • Anterior movement of the tongue followed by backward movement • Lips open and then closes after placement	Bolus is in the mouth. Jaw and lip closure ensures containment of food in the mouth. Lip closure prevents anterior spillage. lips also functions during sucking of liquids,
	Teeth	Tearing and biting of food	Appropriate size of bolus is placed in the mouth
Food lateralization	Tongue	Tongue shifts food laterally between molars	Food between molars enabling mastication

Food mastication	Tongue and jaw	side to side and rotary movement of the tongue	Assists in mastication
	Teeth (molars)	Grinding of food	Bolus formed, with food turning into a paste after it is mixed with saliva
	Cheek	Contraction of cheek muscles	The medial pressure offered by cheek prevents accumulation of food in buccal cavity during mastication
Bolus formation	Tongue and hard palate	Tongue held in cupped position	Food held as a cohesive bolus
	Cheek	The buccal mucosa are responsible for providing the force and modifying the tongue to prepare the bolus by pushing it medially to the mouth.	Food remains medially in the mouth

All the above events, the velum lowers and makes contact with back of the tongue to prevent posterior premature spillage



(a) (b) (c)

Figure 1.1: Events in oral preparatory phase; (a) Indicates the bolus intake, (b) Food mastication, (c) After mastication the bolus is formed and placed at the middle of the tongue.

During this phase, factors such as taste, temperature, viscosity and size of bolus are sensed. The information regarding, temperature, texture, viscosity and size are mediated by the sensory branch of the trigeminal nerve. Taste receptors are found in the oral portion of tongue and its base. The sensory information regarding the taste from the anterior 2/3rds of the tongue is mediated by cranial nerve VII and from the posterior one third of the tongue is mediated by the cranial nerve IX. The teeth also provide sensory information about the nature of the bolus via the cranial nerve V. This sensory information helps to modulate chewing force, speed, duration and jaw excursion.

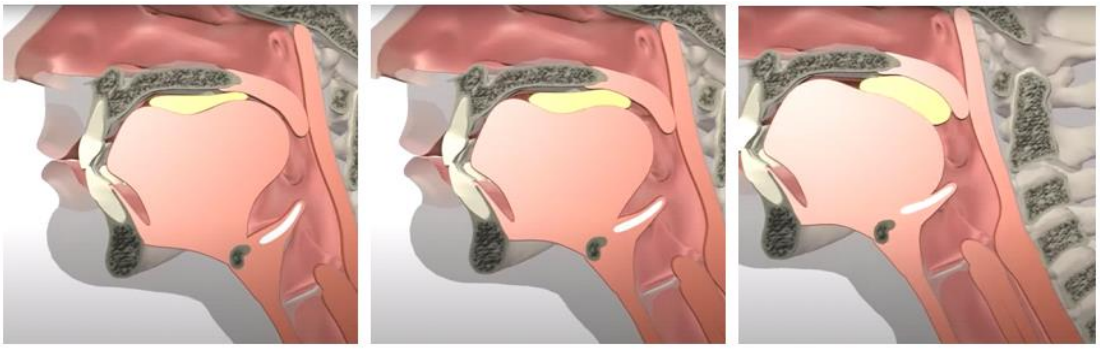
Oral propulsive phase: Though tongue is the main propeller of the bolus during this phase, other structures such as the lip, cheeks, mandible and the soft palate are involved in this phase. This phase is primarily a ‘delivery system’ and begins at the point where the bolus is propelled posteriorly in the oral cavity. The lips and buccal muscles contract, which will reduce the volume of the oral cavity and increases pressure inside

the cavity. The velum elevates sealing the naso-pharynx, which prevents nasal regurgitation. The posterior tongue is depressed and the anterior and middle portions of the tongue sequentially elevate and propel the bolus into the oropharynx. This phase lasts for 1 to 1.5 seconds. The events that occur the structures involved and the function in the oral propulsive phase are depicted in the table below.

Table 1.2:

Events in the oral propulsive phase with the structures involved and their function

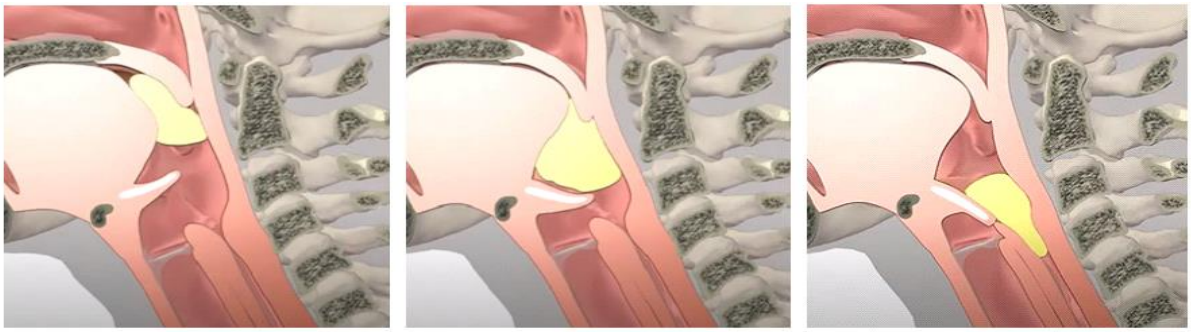
Event	**Structures involved**	**Function**	**End result**
Bolus propulsion	Lip, tongue and jaw	• Tongue progressively elevates anteriorly to posteriorly • Groove created in the midline	Bolus moves thought the oral cavity Guides the material down the tongue
	Lip, mandibular and buccal muscles	They contract	Decreases volume of the oral cavity, thereby increasing pressure, which assists propulsion
	Velum	Velum elevates sealing the naso-pharynx	Prevents the entry of bolus into the nasopharynx



(a) (b) (c)

Figure 1.2: (a) Lip and buccal muscles contract and posterior tongue elevates to prevent premature spillage, (b) Tongue progressively elevates anteriorly to posteriorly, (c) Nasopharynx seals, the anterior tongue moves up and bolus is pushed to the posterior part of the mouth.

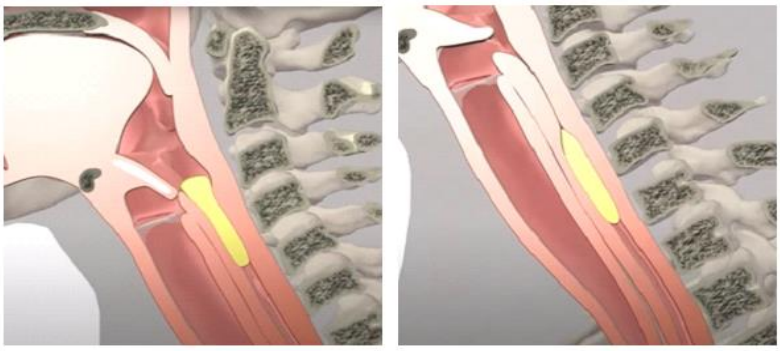
Pharyngeal phase: The pharyngeal phase is reflexive. Once the bolus enters the anterior faucial pillars, sensory impulses from the glossopharyngeal and the vagus nerve initiates the pharyngeal swallow. The velar elevation seals the nasopharynx. The base of the tongue retracts towards the pharyngeal wall and the pharyngeal all contracts towards the base of the tongue. This creates pressure in the pharynx which helps to propel the bolus through the pharynx into the esophagus. Elevation and forward movement of the hyoid bone is initiated, which results in elevation and anterior movement of larynx. A reflexive closure of the laryngeal inlet occurs in which the true vocal folds, false vocal folds and aryepiglottic folds adduct. The epiglottis tilts and the base of the epiglottis makes contacts with the aryepiglottic folds. All the events protect the airway. The hyolaryngeal elevations pulls open the cricopharyngeal sphincter thus allowing the passage of the bolus into the esophagus. This phase lasts for a duration of 1 second. The pharyngeal phase has been depicted in the figure below.



(a) (b) (c)

Figure 1.3: (a) Nasopharynx seals, the base of tongue retracts and pharyngeal wall contracts, (b) Hyolaryngeal elevation, initiated by the elevation of hyoid, (c) Epiglottis tilts to contact the aryepiglottic folds, laryngeal inlet closes and the cricopharyngeal sphincter opens and bolus transits towards oesophagus.

Oesophageal phase: The oesophageal phase begins when the bolus enters the oesophagus. The esophageal phase begins when the cricopharyngeal sphincter is mechanically pulled open and the bolus enters the esophagus. Once the food reaches the esophagus, everything reaches back to the normal state; the soft palate lowers, the epiglottis moves back in place and the larynx lowers. A peristaltic wave transports the bolus through the lower esophageal sphincter into the stomach. It is an initial wave of relaxation, followed by a wave of contraction that propels the bolus. The true peristalsis occurs at the level of thoracic esophagus, initiated by the autonomic nervous system. This phase lasts between 8-20 seconds. As shown in figure 1.4.



(a) (b)

Figure 1.4: (a) The bolus reaches the oesophagus and the velum lowers, (b) The larynx lowers and epiglottis moves back to its place and peristaltic wave transports the bolus through the oesophagus.

CHAPTER II

ORAL DYSPHAGIA AND ITS IMPACT

From the previous section, it is apparent that swallowing is a complex processes involving the nervous system and several muscles. The swallowing apparatus begins with the mouth and includes the lips, the tongue, the oral cavity, the pharynx, the airway, and the esophagus and its sphincters. If there is any abnormality of one or more parts of the swallowing apparatus or in the nervous system, that could result in dysphagia.

Dysphagia refers to difficulty in swallowing of fluids and/or solid food. Any disruption in the swallowing process during bolus transport from the oral cavity to the stomach is referred to as dysphagia. Dysphagia occurs due to several reasons, from mechanical problems of the swallowing mechanism, neurological disorders, gastrointestinal disorders, or loss of organs due to surgical or traumatic injury. Since the focus of this manual is oral dysphagia, a few causes that affect the oral phase have been included. However some of these causes can also lead to pharyngeal dysphagia. Some of the causes of oral dysphagia are oral infections, scleroderma, facial trauma, congenital-cleft lip and palate, temporo-mandibular joint disorders, salivary gland pathology, oral cancers, surgical resection of the oropharynx, complication of head or neck surgery, radiation therapy, bad teeth, xerostomia, stroke or some neurological disease like Parkinson's disease, multiple sclerosis or Amyotrophic Lateral Sclerosis, poliomyelitis, Alzheimer’s disease, immune diseases such as Diabetes mellitus, myasthenia gravis, metabolic myopathies such as thyroid myopathy and Kearns-Sayre syndrome, Muscular dystrophy, etc.

Some of the complications of dysphagia include the aspiration, dehydration, (decreased water content in the body), malnutrition (decreased nutrients in the body), and airway obstruction. If aspiration, a condition in which foods, liquids or oropharyngeal secretions pass into the airway below the level of the vocal folds, occurs frequently, it leads to lung infections or aspiration pneumonia. Aspiration pneumonia is a common

cause of death in hospitalized patients. The inability to swallow may lead to a decline in general health and psychological well-being.

Dysphagia, even when subtle, leads to functional limitation and limits activities and participation, thereby affecting patient's quality of life. It may restrict their diets to pureed food and reduce the quantity of intake due to difficulty in chewing. Eating may be more effortful with increased duration for meal intake. Eating small meals and avoidance of certain foods may fail to meet the daily nutritional requirements. Patients may also report that food goes all over the mouth and they may bite their tongue and cheek. Some compensatory behaviours may be seen during eating and drinking such as cranio-cervical flexion followed by slow extension of the neck to control the transfer of the bolus at the junction of the mouth and pharynx, use of fingers to push the bolus toward the oropharynx, use of fingers to place the bolus on the molar teeth when muscles of the tongue are weakened and exhibit vertical as opposed to rotary chewing. Some patients will prefer to drink liquids through a straw, using suckle feeding behaviour of infancy to overcome impairments associated with oral dysphagia. Others do not know what to do with the food placed in front of them, or even with food placed in their mouth, they exhibit improper bolus sizing, inappropriate speaking and/or breathing during feeding, which can be due to cognitive dysfunction. Due to these and several other issues, they may be reluctant to attend social events or functions where food is served, may avoid eating in a group or to a restaurant.

If there is disruption, specifically in the oral phase, it is referred to as oral phase dysphagia. This section will focus on oral dysphagia and its impact. "Operationally defined, oral phase dysphagia includes a single impairment or any combination of the following: poor bolus formation and manipulation, reduced containment in the oral cavity (anteriorly, laterally, or posteriorly), impaired mastication, and weakened or absent lingual propulsion of the bolus" (Stierwalt & Youmans, 2007). The signs of oral dysphagia and the underlying cause have been depicted in Table 2.1. Accurate identification of specific dysphagia symptoms is critical to effective intervention.

Table 2.1:

Signs of oral dysphagia and the possible deficit

Sl. No.	Phase	Sign	Possible deficit
1.	Oral preparatory	Failure to place an appropriate size bolus in the mouth (Bolus placement difficulty)	Cognitive dysfunction or motor deficits (Upper limb weakness)
2.		Impaired/inefficient opening of the mouth to receive the bolus (Bolus reception difficulty)	Locked jaw/jaw clenching/increased tone in the jaw
3.		Impaired/inefficient biting (Bolus intake difficulties)	Poor dentition/ underdeveloped maxilla/ dental misalignment/ Inadequate jaw strength
4.		Impaired ability to suck though straw/ clear spoon (Bolus intake difficulties)	Inadequate lip mobility and strength
5.		Failure to push food from front of mouth to between molars (Bolus lateralization difficulty)	due to weakness/absent tongue Inattention to eating (cognitive dysfunction)

6.		Impaired/Inefficient/Laboured mastication (Bolus manipulation difficulty)	Inappropriate jaw movement and strength/ Under developed maxilla/dental misalignment or lack of dentition.
7.		Anterior spillage of food or saliva before, during or after swallow (Oral spill at lips- Bolus containment difficulty)	Poor lip seal or tongue thrust/protrusions, decreased tongue control
8.		Impaired perception of the sensory aspects of food such as taste, temperature, texture, volume etc. (Bolus formation difficulty)	Reduced oral sensation due to impairment of sensory branch of cranial nerves supplying the structures in the oral cavity
9.		Food selectivity /Rejection/ refusal of food	Oral hypersensitivity
10.	Oral propulsive phase	Premature spillage over base of tongue prior to initiation of swallow (Bolus containment difficulty)	Reduced oral sensation and inappropriate tongue movement and strength

11.		Pooling or residue in the anterior sulcus (buccal pocketing-Bolus formation difficulty)	Poor tone in the lip muscles or due to reduced oral sensation or due to reduced tongue movement and strength or xerostomia
12.		Pooling or residue in the lateral sulcus (buccal pocketing-Bolus formation difficulty)	Poor tone in the cheek muscles or due to reduced oral sensation or due to reduced tongue movement and strength, or xerostomia
13.		Residue on the tongue and hard palate (Bolus formation difficulty)	Xerostomia
14.		Piecemeal deglutition (multiple swallows per bolus)- Bolus propulsion difficulty	Reduced sensation on the tongue,, due to tongue pumping as in PD

It is essential to assess the extent of impairment, and its impact on functional limitation and participation. There are several tools to assess the swallowing impairment. The table below depicts some of the standardised tools that would be useful in assessing the extent of impairment in the oral and pharyngeal phase of swallow.

Table 2.2:

Specific tools that are useful in the assessment of dysphagia.

Tool	Authors	Population	Remarks
Manipal manual for swallowing assessment	Radish Kumar and Jayashree Bhat in 2012.	Adults with dysphagia irrespective of etiology.	Assess both sensory and motor skills in oropharyngeal phase of swallowing.
Mann Assessment of Swallowing Ability	Mann in 2002	Initially developed for stroke and later modified into several versions catering the cause in question.	24 items that assess both oral and pharyngeal phase of swallow.
Schedule for Oral Motor Assessment (SOMA)	Reilly, Skuse, Stevenson, and Mathisen in 1995.	For children below the age of 2 years	Assess the oral motor skills and narrows the probable causes for feeding difficulties.
Nair Hospital Swallowing Assessment Scale (NHSAS)	Babani and Hattiangadi	For adults with oropharyngeal dysphagia.	Grades the swallowing ability on a 7-point ordinal scale for parameters concerning both the oral and pharyngeal phase of swallow.

The functional limitation, participation and quality of life measures are other crucial aspects in the evaluation of dysphagia. Some of the most sought after tools includes Eating Assessment Tool (EAT-10) by Belafsky et al. (2008), Swallowing Quality of life (SWAL-Qol) given by McHorney et al. (2002), Dysphagia Handicap Index (DHI) developed by Silbergleit et al., in 2012, translated in Kannada by Rahul Krishnamurthy and Radish Kumar Balasubramanium in 2020.

CHAPTER III

STRATEGIES TO REDUCE ORAL DYSPHAGIA

The main goal of any rehabilitation would ultimately be to bring out the best quality of life for the patient. The primary objectives of swallow rehabilitation is to increase swallow safety and efficiency, thereby improve activity of eating and drinking and promote participation in all social scenarios. Swallowing exercises aim to achieve permanent functional improvement in swallowing through alterations of physiological impairment. The major treatment modalities for swallowing disorders include compensatory swallowing therapy and rehabilitative swallowing therapy. Compensatory swallowing therapy refers to strategies that aim to ensure safe swallows without directly improving the physiology of swallowing. They are used as an immediate temporary measure to ensure swallow safety and are not associated with long term changes. However, the rehabilitative swallowing therapy refers to the exercises and techniques that aim to achieve long term improvement in the neuromuscular control of swallowing. They are preferred because of presumed long term nature of the changes produced. These exercises follow the principles of neuromuscular rehabilitation, which are use it or lose it, use it and improve it, specificity (Langmore & Pisegna, 2015). The frequency and number of repetitions needed to induce changes are also important principles in neuromuscular rehabilitation. This indicates that the exercises need to be carried out as many times as possible and the target exercises should be specific and should always involve swallowing.

This manual focuses on the rehabilitative swallowing therapy, particularly to improve the oral dysphagia. It is also in line with the principles of neuromuscular rehabilitation. As pointed out in the previous sections, oral dysphagia could include bolus intake, placement, manipulation, formation or propulsion difficulties, hence this section describes exercises that can be carried out to reduce these difficulties. It has been further subdivided based on the type of difficulty, ways to recognise and the activities to reduce these difficulties. The exercises under each subsection are subdivided into two main parts, i.e. exercises that target the underlying impairment and exercises that improve

the activity of eating and drinking. The exercises in the first subsection are focussed towards improving target muscle and movements important for executing the oral preparatory and propulsive phase. The exercises progress in the order of tone management, range of motion exercises, and strengthening exercises. The tone management section describes activities to alter the tone such as:

- **Massage***:* Massage consists of stroking, kneading, and rubbing muscles in preparation for active exercise so that functional performance is enhanced (Engel, 1998). It facilitates relaxation of the musculature. It improves local blood flow, pain relief, and muscle suppleness.
- **Tapping***:* Otherwise called as 'tapotement' stimulates the muscle spindles and thereby increasing the tone of the muscle. It is done by striking the belly of the intended muscle with the fingertips during active muscle contraction.
- **Stretching***:* Stretching is the movement of a muscle or muscle group outside of its typical operating range. Stretching exercises are employed to either increase or decrease muscle tone. There can be two types; slow and quick stretch. The slow stretch inhibits stretch reflex and thereby reducing the tone. The quick stretch stimulates the muscle spindles eliciting a stretch reflex and increasing the tone.
- **Temperature stimulation**: The stimulation to an articulator can be carried out using cold or hot stimuli. The rationale varies for both. The hot stimulation results in vasodilation, increasing blood supply and oxygen to the area of interest. This type can be very useful for individuals who require relaxation to the musculature and also for maintenance of tone. The cold stimulation is reflexive and results in vasoconstriction. This is mainly used to initiate movement to a muscle that has been damaged or affected, resulting in reduced tone. Cold stimulus helps to reduce spasticity in muscles because it decreases nerve conduction speeds (Clark, 2003). Quick icing of a muscle can facilitate muscle activity, and it may also reduce muscle spasm. It also results in increased oral awareness ultimately resulting in contraction of the muscle. It is recommended to do cold stimulation for a lesser duration than hot stimulation. A maximum of 15 minutes is usually recommended for cold stimulation.
- **Range of motion exercises**- Here a muscle or muscle group is moved through its complete range of expected movement, not beyond the range. These again could be active or passive.

Passive exercise is the movement of a muscle or muscle group with the assistance of a clinician. Active exercises would involve independent movement of the muscle without assistance of the clinician.

- **Strengthening exercises***:* Strength is the capacity of a muscle to produce adequate tension for both posture and movement (Smidt & Rogers, 1982) and employed in cases of muscle weakness. The muscles are overloaded beyond their normal operating levels.

The second subsection involves activities carried out by presenting food or liquid to the patient and asking them to eat and drink while following specified instructions. However, swallowing treatment is not "one-size-fits-all" therapy. Recognizing patient' individual pathophysiology allows for effective clinical decision-making in terms of what type of physiology-based exercise (intervention) is the most suitable. It should also be noted that eating and drinking is governed by cognition and impaired cognition can lead to certain difficulties in the oral phase. However, the methods to improve cognition are beyond the scope of this manual. When planning treatment, speech-language pathologists must consider multiple factors listed below:

- **Underlying cause of dysphagia:** If the dysphagia is associated with a neurodegenerative conditions such as myasthenia gravis or motor neuron disease, active muscle exercises like range of motion exercises may be inappropriate because it creates fatigue. Knowledge of the speed and potential for recovery of swallowing disorder should be a primary factor in decided whether to initiate therapy. Only compensatory strategies may be needed to allow oral intake in such cases as the patient's swallow recovers.
- **General health status:** It is ideal that therapy is initiated once the patient is medically stable.
- **Cognitive status:** These exercises can be done only if the patient has adequate cognitive skills to follow instructions.
- **Patient motivation and interest:** To be successful in therapy the patient should be motivated to regain their normal swallowing functions. If they are motivated to return to oral intake, they may progress faster during therapy. They should be willing to practice independently or with caregiver support

- **Availability of caregiver support:** Reliable caregiver support is important in order to practice the exercise regularly and in case of patients with mild memory impairment, the role of caregiver is very critical.

  The below are a few general instructions to the speech-language pathologists who use this manual for their patients.

- **Seating**: It is crucial to make the patient sit in an upright position for the exercises, with a relatively straight vertebral column and head facing straight, so that the exercises are efficient and comfortable for the patient. Patient should be seated with their hips low down and their back in contact with the chair in order to avoid compression of abdomen and chest. Both the feet should be resting on the floor and the arms should be allowed to rest on the sides of chair/wheelchair. The posture should indicate a 90^0 angle while doing so. It should be noted that patient's line of sight is parallel to the floor. For patients with hemiplegia the clinician can provide support with the pillow to maintain correct posture.

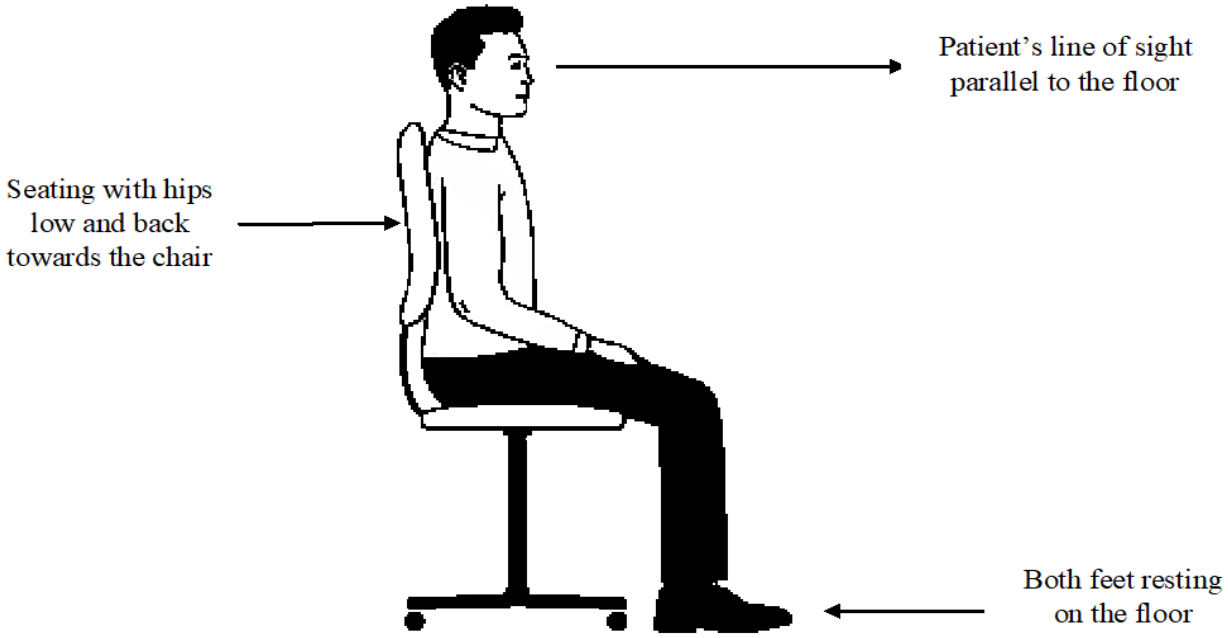


Figure 3.1: Ideal seating posture

Figure 3.2: Posture that will lead to compression of abdomen and chest. Taken from 'Rehabilitation Manual for Dysphagia' by Akai.

- **Reduce tension in the upper body:** The upper part of the body should be relaxed and muscle tension should be minimum. In case the tension is high, get the patients to perform up-and-down movement of the shoulders or passive anterior-posterior flexion and bilateral flexion to relax muscle tension in the shoulders and neck. However, such passive movements may be dangerous if cervical vertebral lesions are present. Deep breathing exercises also help relax the upper body.
- **Stretch in the oral structures**: It should be noted that feeling a tension or a stretch is required as it indicates that the muscles are contracting during the exercises. Stop the exercises in case of any pain felt by the patient.
- **Follow the exercise hierarchy**: If there is associated pharyngeal dysphagia in the patient, while doing exercises that involve food, it is important to ensure that the patient is able to control the food in the mouth without swallowing it, which would increase aspiration risk. In such cases it is important to ensure that the patient achieves good performance of the desired structures by using the relevant exercises without the food or liquid before progressing to introduce it.
- **Hierarchical introduction of bolus:** It is also important to introduce food or liquid in small amounts during the initial stages of training and then gradually progress to increased quantity. Similarly, it is important to vary the other attributes of the bolus from more easy to difficult, for e.g. to introduce foods that are easy to chew, less sticky and more cohesive in the early stages and later progress to foods that are hard and less cohesive. If the flow

speed of the bolus is too fast, the bolus may enter the pharynx before the swallowing reflex is triggered and can result in aspiration.

- **Repetitions:** Repetition is a critical component in achieving progress. The number of repetitions recommended below indicates the generally used numbers, however it is up to the clinician's discretion to decide on increasing or decreasing the number of trials based on the baseline of the patient. Always remember that a large number of repetitions are required for motor learning to be successful. The greater the number of repetitions, faster will be the motor learning leading to positive changes in the nervous system, which will reflect as faster progress in the patient.
- **Feedback**: It is important to provide feedback to the patient during the exercises, so that they stay motivated. Delayed feedback after every three trials facilitates self-evaluation of the response and promotes greater retention. This type of feedback is more effective than immediate feedback provided after every trial. Knowledge of results and performance can be provided to the patient which will also facilitate faster progress.
- **Difficulty level:** Difficulty levels of the exercise should be appropriate for the patient's level. For example, the passive exercises are first line of choice for individuals with evident weakness when jaw closure itself is not possible. Later the clinician can focus on active exercise.
- **Aids:** Use of devices such as a mirror or a metronome as a feedback mechanism for coarse movements is required during the exercises without food bolus. For the exercises with the food bolus, a mirror will suffice. A metronome is used to improve the rhythmic movements and speed of the articulators during the exercises without food
- **Tailor-made program:** Tailor the exercise program to meet the needs of the person with dysphagia. Select the exercises depending on which activity is affected and also depending on whether tone, range, strength, sensory aspects etc. of the structures of interest are affected or not. For this it is essential to conduct a detailed swallow examination which would include assessment of oro-sensorimotor aspects, cranial nerve exam from among others.
- **Supervision of a meal**: Once food can be ingested, sit with the patient during one meal every day to watch how the patient eats, and offer advice and instruction. Also, care must be taken regarding the position of the patient at the table.

SECTION I

DIFFICULTIES IN BOLUS PLACEMENT

Bolus placement difficulties occur when there is difficulty in opening the mouth to place the food for further processing. This could occur due to reduced lip and jaw mobility and strength.

Recognising bolus placement difficulties:

- ✓ Difficulty in inserting solid food into the mouth
- ✓ Difficulty in biting, for e.g. an apple
- ✓ Difficulty in swallowing certain foods
- ✓ Able to take only liquid/pureed feeds due to the difficulty in opening the mouth
- ✓ Inserting very restricted amount of food during each bolus intake
- ✓ Pain while opening the mouth and chewing
- ✓ Clenching of jaw
- ✓ Unable to speak clearly
- ✓ Discomfort performing activities that involve opening the mouth wide e.g. brushing
- ✓ Discomfort when yawning
- ✓ Poor oral hygiene due to not being able to clean the mouth (bad breath, cavities, and infections)

Possible reasons for bolus placement difficulties

- Tightness in the lower jaw consequent to surgery, injury or chemo/radiation therapy
- Tightness or hypertonia in the lip
- Stiffness in the mandible due to neurological conditions
- Locking of the TMJ(Temporo Mandibular Joint) movement
- Increased stress or anxiety
- Excessive chewing (for e.g., constant chewing of a chewing gum).

I EXERCISES/ACTIVITIES TARGETING UNDERLYING IMPAIRMENT

This subsection includes exercises to normalize the tone of the mandible and lips and enhance their mobility, which will facilitate bolus placement.

A) **Tone management:** The activities mentioned below needs to be done if the tone in the jaw muscles is high.

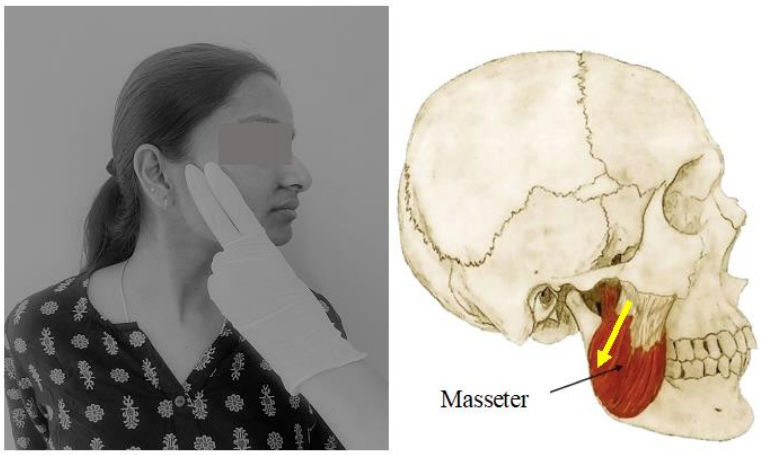
i) Massage: Massage is one of the ways to decrease the tone. It can increase the blood flow to the area, enhancing function.

Jaw massage

Materials: A pair of gloves

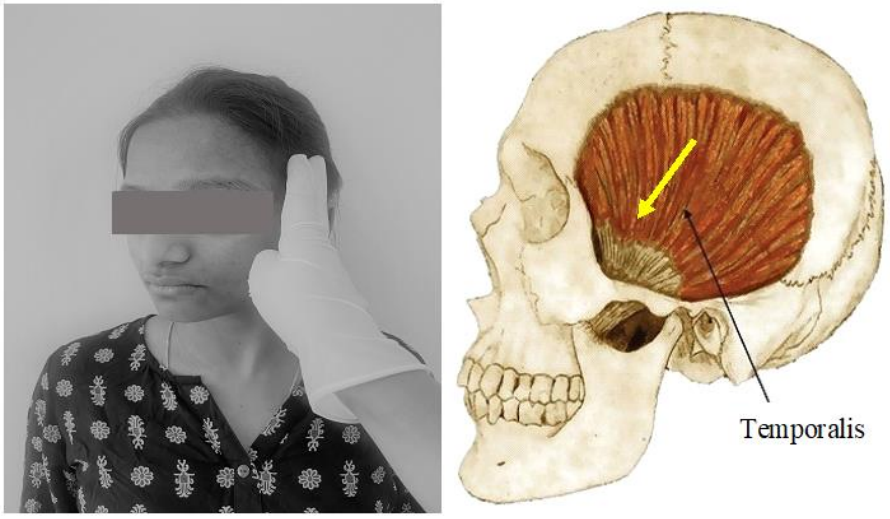
- Ask the patient to relax, sit upright with mouth closed.
- Place the index finger and middle finger on the cheekbone of the patient.
- Run down the fingers over the masseter muscle (Figure: 3.3), which ends at the bottom of the jaw.
- As you move your fingers, find areas that feel tender or tight. Massage these areas with your fingers in a circular motion slowly for thirty seconds.
- The fingers should be placed firmly and deep pressure should be applied.
- Provide head support while carrying out this exercise.
- Perform the massage thrice every day.
- Carry out the same regime for the temporalis muscle. The direction of movement is also from top to bottom. As shown in Figure 3.4.

Note: Massaging is done in one direction only, doing the same in reverse direction would neutralise its effect on the muscle. Carryout the exercise in either clockwise or anticlockwise direction and not in both the directions.



(a) (b)

Figure 3.3: (a) Massaging from the origin to insertion of the masseter muscle (b) Cranium showing the exact orientation of the masseter muscle, the yellow arrow shows the direction of massage. Taken from "Netter's Atlas of anatomy for speech, swallowing and hearing"



(a) (b)

Figure 3.4: (a) Massaging from the origin to insertion of the temporalis muscle (b) Cranium showing the exact orientation of the temporalis muscle, the yellow arrow shows the direction of massage. Taken from "Netter's Atlas of anatomy for speech, swallowing and hearing"

Massaging masseter intra-orally

Materials: A pair of gloves

- Ask patients to open their mouth and place your thumb finger on the inside of the cheek and your index on the outside of the cheek.
- Now ask them to clench their teeth, make sure your finger lies between the teeth and the cheek.
- During clenching, feel for the masseter that tenses. Once you locate the muscle, hold between your index and thumb fingers.
- Stretch the muscle slowly from superior-anterior to posterior-inferior direction (i.e., origin to insertion), as shown in the figure (Figure 3.5) below.
- Carryout this for 15 times.
- This can be done thrice a day.

Note: Use your right hand for the right cheek and left hand for the left cheek, in order to get the placement as shown in figure 3.5.

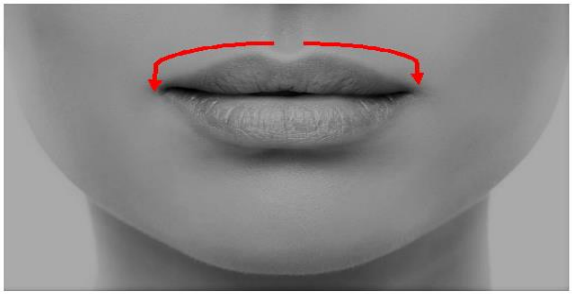
Figure 3.5: Intraoral stimulation of the masseter, with thumb between the inner cheek and teeth and index on the outer cheek, arrow shows the direction of movement.

***Lip Massage**:* Tightness or hypertonia in the lip can also affect bolus placement.

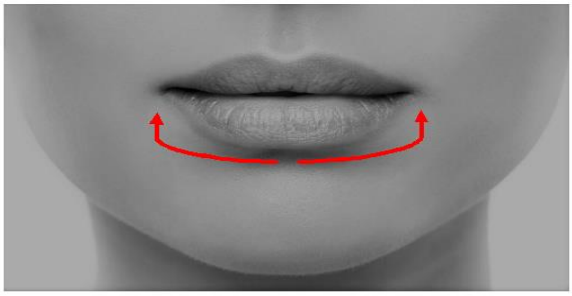
Materials required: Toothbrush, A pair of gloves.

- Ask the patient to relax, sit upright with mouth closed.
  - Begin with the circular motion of massage using fingers initially, on the upper lip of the patient. The fingers should be placed firmly and deep pressure should be applied.
  - As you move your fingers, find areas that feel tender or tight. Massage these areas with your fingers in a circular motion slowly for thirty seconds.
  - Begin from the midline of the upper lip, moving towards the side of the lips.
- Provide head support while carrying out this exercise.
- Perform the massage thrice every day.
  - Once the patient is comfortable with fingers then, progress to using the toothbrush with soft bristles. (Figure 3.6 (a)).
  - This same regime is carried for the lower lip. The muscular orientation for the upper lip is shown in figure 3.6 (b).

Note: It is essential to maintain a circular motion throughout the progression of movement. Use toothbrushes that have soft bristles as the goal here is to provide appropriate sensory stimulation. Rougher bristles will be painful for patients.



(a)



(b)

Figure 3.6: (a) The direction of massage for upper lips, from the midline towards the corners, (b) Direction of massage of lower lips.

ii) Sensory stimulation:

Jaw stimulation

Materials required: Hot bags or hot water-dampened cloth.

- Ask the patient to relax, sit upright with mouth closed.
- Provide sensory stimulation using hot bags or hot water-dampened cloth.
- Massage the temporalis and masseter muscle for a duration of ten to fifteen minutes each.
  - The direction of movement should begin from the origin of the muscle and go along until the insertion, as shown in the figure below (Figure 3.7).
  - Carry out this several times a day.

Note: The heat should not be scolding hot. It should be hot enough such that the patient is comfortable yet feels the heat. Hot stimulation is mainly provided for patient who have pain in locked jaw or TMJ pain, to relieve pain and relax the muscles. It helps reducing tone in this manner.

(a) (b)

Figure 3.7: Origin to insertion of (a) Temporalis muscle, (b) Masseter muscle for the direction of sensory stimulation

Lip stimulation

Materials required: ice cube wrapped around cloth or cold water and clean cotton cloth, a pair of gloves.

- Ask the patient to relax, sit upright with mouth closed.
- The cold stimulation should be given to the orbicularis oris muscle.
- This should be given from the origin of the muscle moving towards the insertion.
- The origin of the orbicularis oris is in the midline of the maxilla and mandible and inserts to the skin and muscle around the mouth.
- The direction of movement for the stimulation is as indicated below. It begins from midline of lip and moves towards the sides. As shown in figures above. (Figure 3.6)
- Carryout this stimulation for 15 minutes.
- Carry out this several times a day.

iii) Slow Stretching: These exercises help in the movement of a muscle or muscle group outside of its typical operating range. If the stretches are done slowly, it will help reduce the tone.

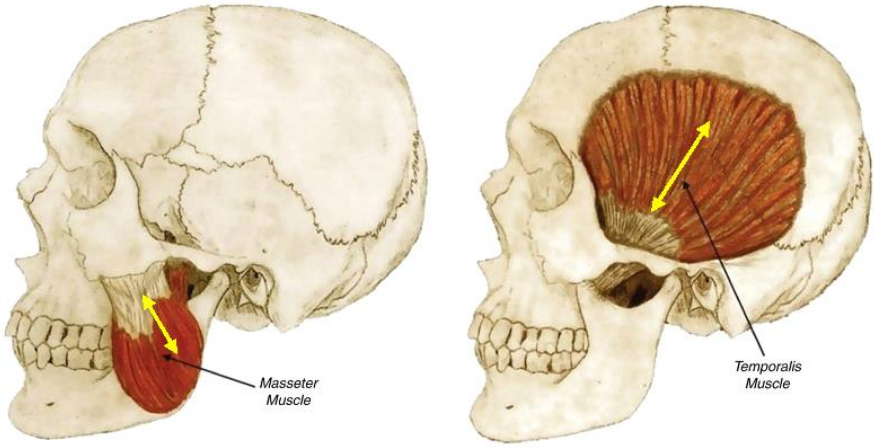
Jaw stretch

Materials required: A pair of gloves.

- Ask the patient to relax, sit upright with mouth closed.
- Carry out slow stretching using a gloved finger.
- Use the thumb and the index finger on the masseter, & temporalis and apply firm directed pressure on the muscles slowly one at a time.
- The fingers begin from the midpoint of the muscle orientation and move towards the end of the muscle, as shown in the Figure 3.8.
- Provide head support while carrying out this exercise.

Note: The speed of providing stretches is important. Slow stretches can reduce the tone, while quick or sudden stretches increase the tone.

(a)



(b) (c)

Figure: 3.8: (a) Demonstration of masseter muscle slow stretching, the arrows indicate the direction of movement, as seen in (b) for masseter muscle and (c) for temporalis muscle. Taken from "Netter's Atlas of anatomy for speech, swallowing and hearing"

iv) Other exercises to reduce tone in the neck and upper body: The reduction of tone in the neck and upper body, eases tension at the level of hyoid bone and improves jaw mobility. In addition, muscles involved in hyoid elevation such as geniohyoid, stylohyoid helps in shortening and elongating the floor of the mouth respectively. Relaxation of these muscles enables a smoother mastication. The mylohyoid also a hyoid elevator depresses the mandible and elevates the oral cavity.

Bending head

- Ask patient to relax, sit upright with mouth closed.

- Get them to bend the head forward and hold it in the same position for thirty seconds, (Figure3.9) after which it needs to be brought back to the midline position.
- Provide physical support in moving the head and maintaining its position, if they are unable to do it independently. Later the support can be withdrawn.
- Get them to do this five times.
- This can be done twice or thrice in a day.
- Relaxation after every trial is recommended.
- The same regime can be followed for bending the head backwards.

Figure 3.9: Bending head forward

Turning head

- Ask patient to relax, sit upright with mouth closed.
- Get them to turn the head towards the left side and hold onto the same position for thirty seconds (Figure 3.10), after which it needs to be brought back to the midline position.
- Provide physical support in moving the head and maintaining its position, if they are unable to do it independently. Later the support can be withdrawn.
- Get them to do this five times.
- This can be done twice or thrice in a day.
- Relaxation after every trial is recommended.
- The same regime can be followed for turning head towards the right side.

Figure 3.10: Turning head to lateral sides

Tilting head

- Ask patient to relax, sit upright with mouth closed.
- Get them to carry out head tilting by bringing the left ear towards the left shoulder initially and hold onto the same for thirty seconds (Figure 3.11), after which it needs to be brought back to the midline position.
- Provide physical support in moving the head and maintaining its position, if they are unable to do it independently. Later the support can be withdrawn.
- Get them to do this five times.
- This can be done twice or thrice in a day.
- Relaxation after every trial is recommended.
- The same regime can be followed for tilting head towards the right side by bringing the right ear towards the right shoulder.

Figure 3.11: Tilting head laterally, the arrows indicate the direction of movement

Rotating head

- Ask patient to relax, sit upright with mouth closed.
- Get them to rotate the head in the clockwise direction slowly five times and then bring the head back to the midline position.
- Provide physical support in rotating the head and maintaining its position, if they are unable to do it independently. Later the support can be withdrawn.
- Get them to do this five times.
- This can be done twice or thrice in a day.
- The same regime can be followed for head rotation in the anticlockwise direction.
- Relaxation after every trial is recommended.

Chin tuck

- Ask patient to relax, sit upright with mouth closed.
- Instruct patient to tuck the chin and hold onto the same position for thirty seconds, (Figure 3.12) after which it needs to be brought back to the midline position.
- Provide physical support in tucking the chin and maintaining its position, if they are unable to do it independently. Later the support can be withdrawn.
- Get them to do this five times.
- This can be done twice or thrice in a day.

- Relaxation after every trial is recommended.

(a) (b)

Figure 3.12: (a) Chin at neutral posture, (b) Position during Chin tuck, arrow indicates the direction of chin movement.

Chin tuck with shoulder blade pinch

- Ask patient to relax, sit upright with mouth closed.
- Get them to tuck their chin as described in the chin tuck exercise above.
- Then ask them to pinch their shoulder blades together as tightly as possible and hold this position for 30 seconds. (Figure 3.13).
- Provide physical support in tucking the chin and bending shoulder backwards, if they are unable to do it independently. Later the support can be withdrawn.
- Get them to do this five times.
- This can be done twice or thrice in a day.
- Relaxation after every trial is recommended.

(a) (b)

Figure 3.13: (a) Shoulder at neutral position, (b) Pinching the shoulders, the arrows indicate the direction of movement

B) Range of motion exercises

The below mentioned exercises need to be done in an active or passive manner. These exercises will improve the movement of muscle and also helps in altering the tone. These can be performed during non-speech tasks and speech tasks as described below.

i) Non-speech tasks

Assisted upper and lower jaw opening

Materials required: A pair of gloves.

- Ask patient to relax and sit upright.
- Place the thumb under top teeth at the midpoint of the mouth of the patient.
- Then place the other hand's index finger on the lower teeth at the centre of the mouth.
- Now, pull the thumb and index finger in opposite direction to keep the jaw from closing. (Figure: 3.14).
- Get the patient to open the mouth as widely as possible. The patient should feel a light stretch and not pain.

- There must be no much force used, rather a slow and simple pull.
- Once the patient can feel some stretch, ask them to hold onto the same position for fifteen seconds and slowly release.
- Repeat the same ten times in a session.
- Relaxation after every trial is recommended.

Note: This is a passive exercise.

Figure 3.14: Passive upper and lower jaw opening assisted by clinician

Assisted lower jaw opening

Materials required: A pair of gloves.

- Ask patient to relax and sit upright.
- Place your fingers on the front four bottom teeth of the patient. (Figure 3.15 (a)).
- Now, pull the mandible down until the patient can feel a light stretch to the jaw and not pain.
- There must be no much force used, rather a slow and simple pull.
- Once the patient can feel some stretch, ask them to hold onto the same position for thirty seconds and slowly release.
- Repeat the same ten times in a session.

- Relaxation after every trial is recommended.

Note: This is a passive exercise. This exercise can also be performed by placing the thumb on the bottom teeth, with the rest the other fingers outside the mouth and pulling the jaw down with the thumb as shown in the figure [Figure 3.15 (b)].

Figure 3.15: Assisted lower jaw opening using (a) Four gingers, (b) Thumb alone.

Assisted jaw movement

Materials required: A pair of gloves.

- Place your four fingers of each hand just in front of the patient's ear, with the thumb under the jaw, in a way to support it. (Figure 3.16).
- Now, ask the patient to alternatively open and close the mouth slowly.
- The fingers should ensure a smooth jaw opening, devoid of any swaying to lateral sides.
- This sequence of movements done for ten repetitions to complete one set.
- A total of five to 6 sets can be completed in a session.

Note: This is a passive stretching exercise.

Figure 3.16: Placement to support the jaw

Assisted graded jaw opening

Materials required: A pair of gloves.

- Ask patient to relax and sit upright.
- Help the patient with jaw opening by placing the thumb under the lower lip and gently but firmly pulling the jaw down to a minimum extent. Figure 3.17(a).
- Ask them to hold onto the same position for thirty seconds and slowly release.
- Repeat the same ten times in a session.
- Then using the same finger, pull down the jaw to a little greater extent compared to the earlier attempt. Repeat the same steps as mentioned earlier.
- Carry out the jaw opening in a step-by-step manner until three fingers can enter the mouth figure 3.17(b).

(a) (b)

Figure 3.17: (a) Jaw opening assisted by thumb, (b) Three finger test for jaw opening, Taken from "Understanding Trismus" by Jill Meyer (2013).

Independent mouth opening

- Ask patient to relax and sit upright.
- Ask patient to open the mouth as wide as possible by imagining that they are going to bite a big apple. Instruct them to open it till they feel that the muscles of the jaw are actually being stretched.
- Get them to hold onto the same position for thirty seconds, after which it can be brought back to the midline position.
- In case the patient is not able to open it independently, he/she can be asked to press the tip of the tongue against the roof of the mouth (behind top front teeth) with gentle pressure and try to do the same.
- Get them to do this five times.
- Relaxation after every trial is recommended.
- Later ask the patient to open and close the jaw alternatively slowly.
- They should be able to feel a stretch while doing the same.
- Ask them to do the same for ten repetitions to complete a set.
- It is recommended to carry out each set five times a day with periods of rest in between. However, it may be noted that the greater the number of practice trials, the better.

Note: This is an active stretching exercise where the patient performs jaw opening independently.

Arm supported jaw opening

- Ask patient to relax and sit upright in front of a table.
- Now ask them to rest both their hands on the table and cup their hands together.
- Get them to place their chin on the cupped hands such that their palm is over the face and the fingers are over their temples. (Figure 3.18).
- Next, ask them to gradually open and close the jaw while maintaining this posture. This will create a graded and stabilised jaw opening and closing.
- This exercise can be carried out for 15 times.

Note: This is a passive stretching exercise as it is assisted by the arm. It can also be considered as a strengthening exercise when the patient is asked to put their entire weight on the arm.

(a) (b)

Figure 3.18: (a) Cupping hands together, elbows resting on the table, (b) Initiating a jaw opening with cupped hands.

Independent Jaw lateralization with closed mouth position

- Ask patient to relax, sit upright and to maintain a closed mouth.
- Instruct the patient to move the mandible towards the right as much as possible. They should be able to feel a stretch of the mandible while doing the same.(Figure 3.19)
- Provide physical support in moving the mandible, if they are unable to do it independently. Later the support can be withdrawn.

- Then, ask them to hold onto the same position for thirty seconds.
- Get them to do this five times.
- This can be done thrice in a day.
- Relaxation after every trial is recommended.
- Follow a similar regime for the mandible movement to the left.

Note: This is an active stretching exercise where the patient performs jaw lateralization independently.

(a) (b)

Figure 3.19: (a) Jaw at neutral position with mouth closed, (b) Jaw lateralisation with mouth closed.

Independent Jaw lateralization with open mouth position

- Ask patient to relax and sit upright.
- Instruct the patient to open the mouth as wide as possible.
- Ask them to slide their jaw to the right and hold the same for thirty seconds. They should be able to feel a stretch of the mandible while doing the same. (Figure 3.20)
- Provide physical support in moving the mandible, if they are unable to do it independently. Later the support can be withdrawn.
- Get them to do this five times in a session.
- This can be done thrice in a day.
- Relaxation after every trial is recommended.

- Follow a similar regime for the mandible movement to the left.
- Later ask the patient to move the jaw alternatively towards the left and right side slowly.
- They should be able to feel a stretch while doing the same.
- Ask them to do the same for ten repetitions to complete a set.
- It is recommended to carry out each set five times a day with periods of rest in between. However, it may be noted that the greater the number of practice trials, the better.

Note: This is an active stretching exercise where the patient performs jaw lateralization independently.

(a) *(b)*

Figure 3.20: (a) Jaw at neutral position with mouth open (b) Jaw lateralisation with mouth open.

Independent Jaw retraction and protrusion

- Ask patient to relax and sit upright.
- Ask patient to move the mandible forward as much as possible, placing the lower teeth in front of the upper teeth.They should be able to feel a stretch of the mandible while doing the same. (Figure 3.21)
- Provide physical support in moving the mandible, if they are unable to do it independently. Later the support can be withdrawn.
- Then, ask them to hold onto the same position for thirty seconds.
- Get them to do this five times.

- This can be done thrice in a day.
- Relaxation after every trial is recommended.
- Follow a similar regime for the backward mandible movement.
- Later ask the patient to move the jaw alternatively back and forth slowly.
- They should be able to feel a stretch while doing the same.
- Ask them to do the same for ten repetitions to complete a set.
- It is recommended to carry out each set five times a day with periods of rest in between. However, it may be noted that the greater the number of practice trials, the better.

Note: This is an active stretching exercise where the patient performs jaw forward and backward movement independently.

(a) (b) (c)

Figure 3.21: (a) Jaw in neutral position, (b) Jaw protrusion, (c) Jaw retraction.

Independent Lower jaw opening with tongue elevation

- Ask patient to relax and sit upright.
- Ask the patient to lift their tongue upward towards the roof of the mouth.
- Now slowly instruct them to pull their mandible down while ensuring that the tongue still contacts the roof and stays behind the front teeth. (Figure 3.22)
- Ensure that they feel a stretch of the masseter and the temporalis during the same. You can touch these muscles and ensure that.

- Then, ask them to hold onto the same position for thirty seconds.
- Get them to do this five times.
- This can be done thrice in a day.
- Relaxation after every trial is recommended.

Note: This is an active stretching exercise.

(a) (b)

Figure 3.22: (a) Mandible opening along with tongue elevation in closed mouth posture, (b) Mandible opening along with tongue elevation in open mouth posture.

Yawn and stretch

- Instruct patient to relax and sit upright.
- Ask the patient to produce a yawn focusing on stretching the mandible muscles.
- Then, ask them to extend their yawn and hold onto the same position for thirty seconds. (Figure 3.23).
- Get them to do this five times.
- This can be done thrice in a day.
- Relaxation after every trial is recommended.
- Other activities such as mimicking a surprised face and saying /ah/ can also be carried out.

Note: This is an active stretching exercise where the patient performs jaw opening independently.

Figure 3.23: Yawning and stretching

Independent circular jaw movement

- Instruct patient to relax, sit upright with mouth partially open.
- Ask the patient to make perform an exaggerated chewing movement which is marked by a rotatory movement of the jaw (circular motions) as fast as possible.
- They should perform this movement first in the clockwise direction and then in the anticlockwise order.
- Ask them to do the same for ten repetitions in both directions to complete a set.
- Relaxing between the clockwise and anticlockwise trial is required.
- It is recommended to carry out each set five times a day with periods of rest in between. However, it may be noted that the greater the number of practice trials, the better.
- The same regime can be performed with the lip closed.

Note: This is an active stretching exercise where the patient performs circular jaw movement independently.

Chewing on a chewy tube

Materials required: a pair of gloves, chewy tubes (Table 3.1)

- Instruct patient to relax, sit upright with mouth partially open.
- Place the chewy tubes at the molars and ask the patient to chew on the same to elicit mandibular mobility, as shown in the table below. Make sure that the stem of the chewy tube touches the cutting surface of the molar teeth.
- Use chewy tubes in the increasing order of complexity.
- Perform this for two to three minutes for each type of chewy tube.
- **Note:** The varying colours of chewy tube serve different purposes, for example the below shown tubes work towards jaw strengthening. The increasing diameters as described challenge the mandibular movement in the increasing order of difficulty. Also chewy tubes that are not hollow, call for increased jaw strength than hollow tubes. Begin with the hollow tubes and then progress to the non-hollow tubes.

Table 3.1:

Table showing the characteristics of different chewy tubes.

Colour	**Characteristics**	**Purpose**	**Picture**
Children			
Red	Large stemmed, smooth, T-shaped	Jaw strengthening	
Yellow	Small stemmed, smooth, T-shaped	Jaw strengthening	

			
Adult			
Orange	Small stemmed, smooth, T-shaped (adult version of yellow tube).	Jaw strengthening, more appropriate for adults.	
Both Adults And Children			
Green Super chew	Non hollow, smooth, closed loop handle to facilitate better grip.	Increasing chewing and biting skills. Increased jaw strengthening	

Red Super chew	Non hollow, textured, closed loop handle.	Increasing chewing and biting skills as well as tactile stimulation. Increased jaw strengthening	

ii) <u>Speech tasks</u>

Production of phonemes

- Instruct patient to relax and sit upright.
- Instruct the patient to say /a/ and /m/ alternatively ten times.
- Ask them to do the same for ten repetitions to complete a set.
- It is recommended to carry out each set five times a day with periods of rest in between. However, it may be noted that the greater the number of practice trials, the better.

Production of CV syllables

- Instruct patient to relax and sit upright.
- Instruct the patient to say consonants that require movement to the mandible.
- They can begin with CV syllables such as /p/, /k/, /t/.
- The material shown below can be used for practice (Figure 3.24).

Meaningless words	Consonant	P–T–K
PA–TA–KA	TA–KA–PA	KA–PA–TA
PA–TA–KE	TA–KA–PE	KA–PA–TE
PA–TA–KO	TA–KA–PO	KA–PA–TO
PA–TE–KA	TA–KE–PA	KA–PE–TA
PA–TE–KE	TA–KE–PE	KA–PE–TE
PA–TE–KO	TA–KE–PO	KA–PE–TO
PA–TO–KA	TA–KO–PA	KA–PO–TA
PA–TO–KE	TA–KO–PE	KA–PO–TE
PA–TO–KO	TA–KO–PO	KA–PO–TO
PE–TA–KA	TE–KA–PA	KE–PA–TA
PE–TA–KE	TE–KA–PE	KE–PA–TE
PE–TA–KO	TE–KA–PO	KE–PA–TO
PE–TE–KA	TE–KE–PA	KE–PE–TA
PE–TE–KE	TE–KE–PE	KE–PE–TE
PE–TE–KO	TE–KE–PO	KE–PE–TO
PE–TO–KA	TE–KO–PA	KE–PO–TA
PE–TO–KE	TE–KO–PE	KE–PO–TE
PE–TO–KO	TE–KO–PO	KE–PO–TO
PO–TA–KA	TO–KA–PA	KO–PA–TA
PO–TA–KE	TO–KA–PE	KO–PA–TE
PO–TA–KO	TO–KA–PO	KO–PA–TO
PO–TE–KA	TO–KE–PA	KO–PE–TA
PO–TE–KE	TO–KE–PE	KO–PE–TE
PO–TE–KO	TO–KE–PO	KO–PE–TO
PO–TO–KA	TO–KO–PA	KO–PO–TA
PO–TO–KE	TO–KO–PE	KO–PO–TE

Figure 3.24: Word list using /p/, /t/, /k/ and various combination of vowels, Taken from "Rehabilitation Manual for Dysphagia" given by Akai.

II EXERCISES/ACTIVITIES TARGETING THE ACTIVITY OF EATING AND DRINKING

Jaw opening for cup placement

Materials required: a pair of gloves.

- The jaw opening required for cup placement is lesser than for solid bolus.
- Ask patient to attempt lowering the jaw.
- Opening can be assisted by placing the index and middle finger below the chin and the thumb on the chin, as shown in the figure. (Figure 3.25)
- An alternative position that can be taken up is thumb on the temporo-mandibular joint (TMJ), the index finger on the jawline and the middle finger below the chin. (Figure 3.26)

- This posture would ensure graded stretch and movement of the muscle to receive the bolus.
- Initiate a gradual opening by using the above placement. Once you have achieved the desired opening, then hold for 15 seconds.
- This opening would vary depending on cup used.
- Carry out this for 15 times.

Note: It is important to note the size of the bolus during the activity. The larger the bolus then more would be the graded jaw opening that is required. In case of children with hypersensitivity, use a silicon spoon to prevent any harm in case of a bite reflex, although this is unlikely in case of adults.

Note: A rimmed cup would require a lesser opening and lesser effort for lip seal and jaw opening. A rimless cup requires more efforts for a lip seal and larger jaw opening.

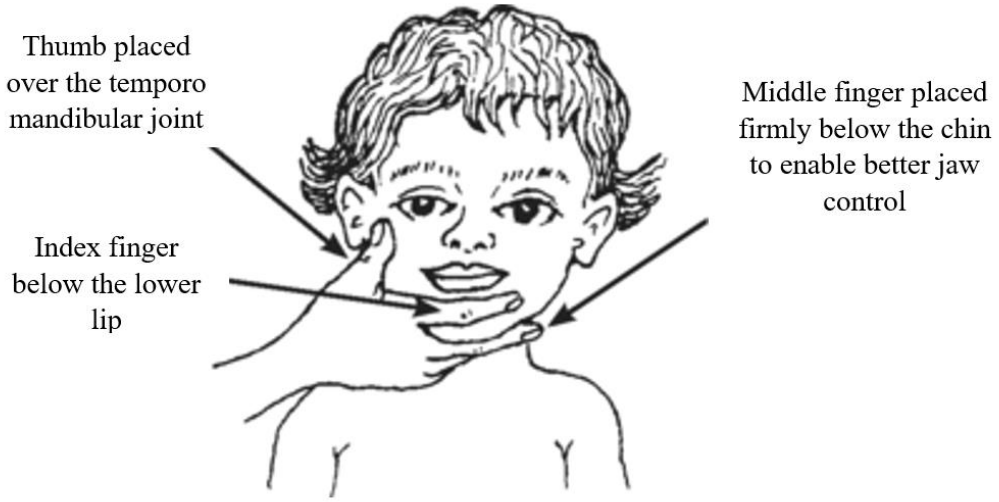


Figure 3.25: Placement of fingers on to initiate graded movement of jaw, this shall be carried out when the clinician is seated beside the client. Taken from "Disabled Village Children" by David Werner

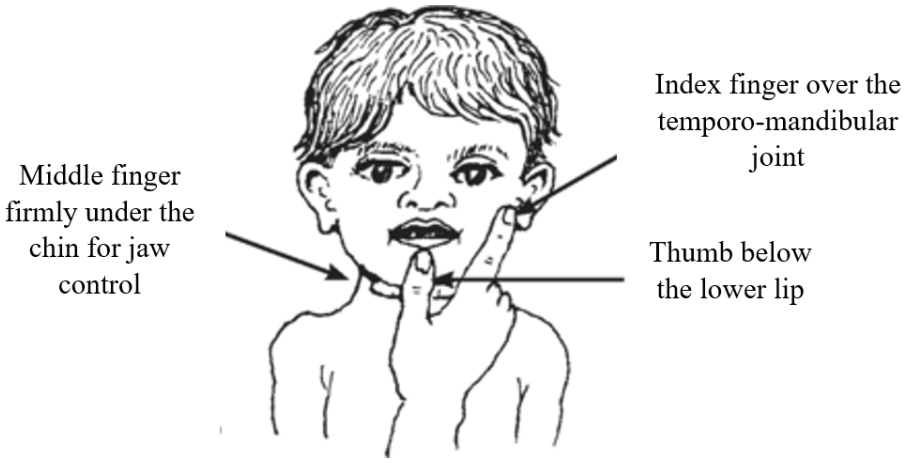
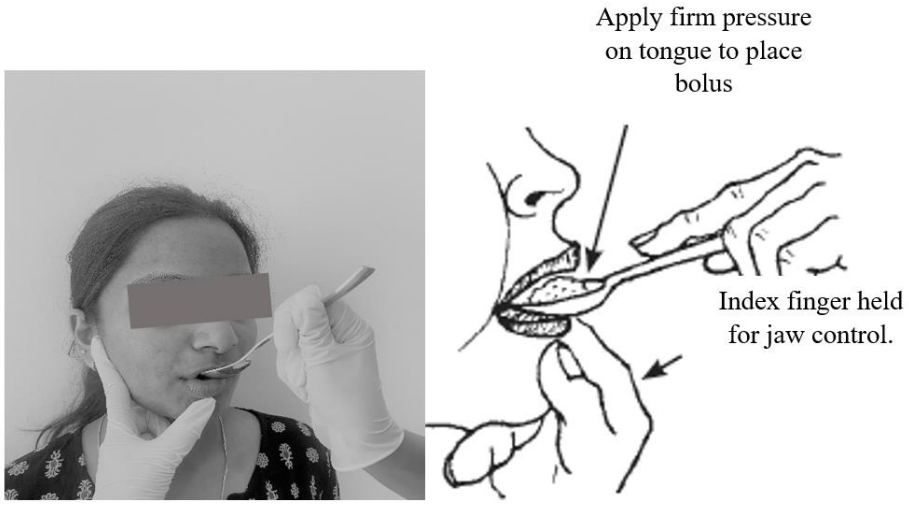


Figure 3.26: Placement of fingers on to initiate graded movement of jaw, this shall be carried out when the clinician is front of the client. Taken from "Disabled Village Children" by David Werner

Graded jaw opening for spoon feeding

- Ask the patient to open their mouth to receive the bolus from the spoon.
- Guide the graded opening using similar placements in the previous exercise.
- Here, once the opening is complete, ensure lip seal until the bolus is completely taken into the mouth.
- Monitor for lip seal and also make sure the patient do not bite the spoon, rather they should allow for food to be removed from the spoon by the lip and the upward and outward movement of spoon (Figure 3.27)
- Placement of the spoon should begin from the less-affected or intact side, and then progress towards gradually towards the affected side.

Note: Begin using spoons that have a broader bowl area and shallower depth so that it is easier to remove the bolus then progress to using spoon with broad and deeper bowl. Use of smaller bowl area should be entertained only when the patient has significant bolus clearance from the above spoon types.



(a) *(b)*

Figure 3.27: (a) Demonstration of graded jaw opening for spoon placement, (b) The manner of placement for spoon. Taken from "Disabled Village Children" by David Werner.

Progression of lip opening

Materials required: Tumbler /cup with liquid, a pair of gloves.

- Instruct the patient to hold a glass or cup to the lips.
- Get them to practice the timing of opening the lips once the cup is placed on the lower lip. The opening should be immediate.
- Monitor for the lip symmetry and also adequate lip retraction to receive the bolus.
- Repeat this until they learn to open their lips immediately to receive the bolus.
- Once the opening is achieved, progress to using spoon placement.
- Even with liquid bolus, there needs to be a progression followed. Begin with the easiest form of bolus and then move to thicker consistencies like semi-solid, pudding thick, honey thick and then liquid.
- Lip closure after the bolus placement is also another function to be monitored; observe for correct symmetry and retraction after the bolus is placed into the mouth.

Placement of a liquid bolus

Materials required: Cotton ball, gauze piece, thick liquid, a pair of gloves.

- Wrap a clean cotton ball inside a gauze cloth.
- Instruct the patient to open the mouth and get them to place the gauze in the mouth. Later ask them to close their mouth.
- Practice the timing of opening the mouth once the gauze ball is placed. The opening should be immediate.
- Ask them to do the same for ten repetitions to complete a set.
- Once the bolus placement is learnt, you can also dip the gauze ball into any thick liquid which the patient enjoys. They can press the gauze ball against the palate and extract the liquid and swallow, provided they are not at risk for aspiration. (Figure 3.28)
- Later the liquid can be presented with a spoon and the patient can be asked to open the mouth and receive the liquid.
- It is recommended to carry out each set five times a day with periods of rest in between.

(a) *(b)*

Figure 3.28: (a) Long gauze cloth wrapped around a ball of clean cotton ball (b) Gauze cloth dipped on juice

Placement of a solid bolus

Materials required: Soft solid food, a pair of gloves.

- Take a small piece of food. This could be some soft food item such as a banana or idli
- Follow the same procedure as detailed above. Instruct the patient to open the mouth to receive the solid bolus.
- During this make sure, the patient is able to lower the jaw based on the size of the bolus, as the opening required to place the solid bolus would be much greater than that required for spoon or cup.
- Then place the bolus on the least-affected or the better side. The bolus is initially placed on the premolars of the lower teeth.
- This would involve lowering of mandible and also ensure a lip seal, after bolus placement.
- It is also important to monitor the time taken for this graded jaw opening to take place.
- Carryout this regime four times a day.

SECTION II

BOLUS CONTAINMENT OR RETENTION DEFICITS

This occurs when food or liquid escapes the front of the mouth, referred to as anterior spillage. Adequate labial seal or ability to keep lips closed prevents this leakage. Appropriate jaw strength is also essential.

Recognizing bolus containment or retention deficits:

- Asymmetry of lips
- Open mouth with a dropping jaw
- Tongue pushing the food out of the mouth
- Drooling
- Spilling out food when fed especially while feeding through spoon
- Greater difficulty in taking liquids
- Difficulty in drinking through a straw

Possible Reasons

- Weakness on one side or both side of the lips causing reduced mobility and strength
- Weakness in the jaw leading to poor jaw mobility and strength
- Reduced sensation of food/liquid in the mouth, on lips or around the mouth
- Tongue thrust

I EXERCISES/ACTIVITIES TARGETING UNDERLYING IMPAIRMENT

This subsection includes exercises to enhance lip mobility, which will facilitate bolus retention or containment.

A) Tone management: The activities mentioned below needs to be done, if the tone in the lip and jaw muscles is low.

i) Tapping: Tapping is one of the ways to increase the tone.

Tapping jaw muscles

Materials required: a pair of gloves.

- Ask the patient to relax and sit in the upright position, with the mouth closed.
- Tap on the masseter with fingers in a rhythmic manner with the finger tips.
- Tap along the direction of the origin to insertion of the muscle, as shown in pictures before. (Figure 3.7)
- Provide head support while carrying out this exercise.
- Perform the tapping ten times to complete a set.
- Perform this thrice every day.
- Follow the same regime for the temporalis muscle.

ii) Quick stretching: These exercises help in the movement of a muscle or muscle group outside of its typical operating range. If the stretches are done quickly, it will help increase the tone.

Jaw stretch

Materials required: a pair of gloves.

- Ask the patient to relax, sit upright with mouth closed.
- Carry out quick stretching using a gloved finger.
- Use the thumb and the index finger on the masseter, medial pterygoid and temporalis and apply firm directed pressure in the direction of the origin and insertion of the muscles slowly one at a time. (Figure 3.7)
- Provide head support while carrying out this exercise.

Note: The speed of providing stretches is important. Slow stretches can reduce the tone, while quick or sudden stretches increase the tone.

Jaw stretching simultaneously with jaw opening

Materials required: a pair of gloves.

- Use the palm of your fingers and place them on either side of the patient's forehead.
- Feel for the temporalis muscle and place the palm at the location where temporalis muscle insertion is present.
- Now ask them to gradually lower the mandible.
- While the patient are doing the same, move your palm from posterior to anterior direction towards the origin (Figure 3.29)
- The same is done for masseter muscle; here the palm moves inferiorly as jaw opening takes place.
- This can be carried out for 15 times.

Note: This exercise is generally recommended for patient with TMJ pain (temporo-mandibular joint). This stretch carried out during jaw opening, which allows for easing the tensed musculature.

Figure 3.29: Jaw stretching with simultaneous jaw opening, the red arrows indicate the posterior to anterior strecth of the temporalis while the yellow arrows indicate the simultaneous jaw opening.

iii) <u>Quick stroking</u>

Jaw muscles

Materials required: toothbrush, a pair of gloves.

- Ask the patient to relax, sit upright with mouth closed.
- Begin brushing the masseter muscle and the temporalis.
- Place the toothbrush as shown below and move it in the direction of movement of the muscles.
- This can be repeated ten times to complete a set.
- It is recommended to carry out each set five times a day with periods of rest in between. However, it may be noted that the greater the number of practice trials, the better.

Note: If the patient shows hypersensitivity or any other acceptance issues, begin with your index finger by making the same firm and quick strokes followed by a release and then progress to using toothbrush.

Lip muscles:

Materials required: Toothbrush with soft bristles, a pair of gloves.

- Ask the patient to relax, sit upright with mouth closed.
- Begin brushing the upper lip of the patient with firm and quick strokes, followed by a sudden release.
- Place the toothbrush at the midline of the lips and stroke towards the corners of the mouth, as shown in Figure 3.30 for the upper lip. The same regime can be carried out for the lower lip as well.
- This can be repeated ten times to complete a set.
- It is recommended to carry out each set five times a day with periods of rest in between. However, it may be noted that the greater the number of practice trials, the better.

Note: If the patient shows hypersensitivity or any other acceptance issues, begin with your index finger by making the same firm and quick strokes followed by a release.

Figure 3.30: Quick stroking of upper lip from midline towards the lateral sides

iv) <u>Sensory stimulation:</u>

Jaw stimulation

Materials required: ice cubes, cloth, a pair of gloves.

- Ask the patient to relax, sit upright with mouth closed.
- Provide sensory stimulation using ice cubes wrapped in cloth.

- Massage the temporalis and masseter muscle by rubbing along the direction of muscle orientation for a duration of ten to fifteen minutes each, as shown in Figure 3.7.
- Use a smoothened ice cube and a slow and soft movement across the orientation of the muscle.
- Massage the jaw muscles for 10-15 minutes
- Carry out this several times a day.

Note: Make sure to not press and stimulate as this becomes painful for the patient.

Lip stimulation (Sucking an ice popsicle)

Materials required: ice popsicle

- Ask the patient to relax, sit upright with mouth closed.
- Provide a popsicle of choice and asked the patient to suck on it, which will stimulate the muscles that are involved in the puckering of the lip.
- Ask them to carry this out for ten minutes.
- Focus on the stimulation to the lip and ensure that the popsicle is not bitten by the patient.

B) <u>Range of motion exercises</u>

i) <u>Non-speech exercises</u>

Chewy tubes:

- Another jaw movement based exercises that works towards the TMJ pain in adults is the navy blue chewy tube.
- Introduce this to the patient on either back side of the lower teeth.
- Encourage the patient to chew in a slow, graded and rotatory pattern.
- Carryout the activity for 15 seconds.
- Recommended to be done before meal times.
- The diameter and texture of the tube helps with pain of the Temporo Mandibular joint.

- Note: The chewy tube that can be taken up for the same could be Navy blue tube, which is a hollow, large-stemmed, T-shaped tube for adults and mainly used for TMJ stimulation and elimination of teeth grinding.

Lip retraction

- Ask the patient to relax, sit upright with mouth closed.
- Instruct the patient to retract his lips (hold in the smile position) as much as possible. (Figure 3.31)
- Get them to hold for thirty seconds.
- They should be able to feel the stretch in the muscle.
- This can be repeated ten times to complete a set.
- It is recommended to carry out each set five times a day with periods of rest in between. However, it may be noted that the greater the number of practice trials, the better.

Note: While smiling, the patient's upper teeth, lower teeth and gums should not be visible. There should be no squinting of the eyes while doing the same.

(a) (b)

Figure 3.31: (a)Lip at neutral position, (b) Retraction of lips

Lip protrusion

- Ask the patient to relax, sit upright with mouth closed.
- Instruct the patient to make various lip positions such as protrude the lips as if to say /u/. They should be able to feel a stretch while doing the same.
- Provide physical assistance in case they are unable to do it independently
- Get them to hold for thirty seconds.
- This can be repeated ten times to complete a set.
- Later instruct the patient to pucker the lips and then retract as fast as possible.
- Ask them to do the same for ten repetitions to complete a set.
- It is recommended to carry out each set five times a day with periods of rest in between. However, it may be noted that the greater the number of practice trials, the better.

Note: If the mandible opens and closes during lip protrusion and retraction, ask them to bite on a bite block or tongue depressor or even ice cream stick to stop the mandible from moving. It is important to ensure that the patient hold the tongue at rest.

Lateral lip protrusion

- Ask the patient to relax, sit upright with mouth closed.
- Instruct the patient to pucker lips as if to say /u/.
- Hold for five seconds.
- Once the patient have achieved the same, then ask them to move the puckered lip position towards the right and hold onto the same for five seconds.
- Next, ask them to move towards the left and hold for five seconds.
- This can be repeated ten times to complete a set.
- Later instruct them to continuously move the pucker from left to right ten times.
- It is recommended to carry out each set five times a day with periods of rest in between. However, it may be noted that the greater the number of practice trials, the better.

Note: It is important to ensure that the patient hold the tongue at rest.

Lip rounding

- Ask the patient to relax, sit upright with open their mouth as wide as possible
- Make sure the lips hide their teeth.
- Now from this position get them to pucker lips to an "O" position.(Figure 3.32)
- Hold the above position for five seconds each.
- This can be repeated ten times to complete a set.
- Later instruct them to alternately round their lips and bring it to the original position as fast as possible.
- It is recommended to carry out each set five times a day with periods of rest in between. However, it may be noted that the greater the number of practice trials, the better.

Note: It is important to ensure that the patient hold the tongue at rest.

Figure 3.32: Lip kept at an 'O' position

Lip press

- Ask the patient to relax, sit upright with mouth closed.
- Instruct them to press their lips tightly for five seconds. (Figure 3.33)
- Provide physical assistance in achieving the closure if required.
- Relax after every trial.
- This sequence can be repeated ten times to complete a set.

- It is recommended to carry out each set five times a day with periods of rest in between. However, it may be noted that the greater the number of practice trials, the better.

Figure 3.33: Lip pressing

Extended lip squeeze followed by lip retraction

- Ask the patient to relax, sit upright with mouth closed.
- Instruct the patient to squeeze the lip tight.
- Get them to hold for 2-3 seconds.
- Next ask them to retract their lips.
- Again get them to hold for 2-3 seconds.
- Now ask them to repeat both these movements alternately for ten repetitions. (Figure 3.34)
- They should be able to feel a stretch while doing the same.
- Ask them to do the same for ten repetitions to complete a set.
- It is recommended to carry out each set five times a day with periods of rest in between. However, it may be noted that the greater the number of practice trials, the better.

(a) (b)

Figure 3.34: (a) Extended lip squeeze followed by (b) Retraction of lips

Raising lower lip

- Ask the patient to relax, sit upright with mouth closed.
- Instruct the patient to raise only lower lip, as high as possible. (Figure 3.35)
- Get them to hold the same position for five seconds.
- This can be repeated ten times to complete a set.
- Later instruct them to raise the lower lip and bring it to the original position as fast as possible.
- It is recommended to carry out each set five times a day with periods of rest in between. However, it may be noted that the greater the number of practice trials, the better.

Figure 3.35: Raising of lower lip

Puffing up cheek

- Ask the patient to relax, sit upright with mouth closed.
- Instruct them to puff up the cheeks and hold onto the same position for ten seconds.
- Also ask them to move the puff of air to the right side and hold for ten seconds.
- Let them perform the same for the left side as well.
- This movement from one cheek to another is done for ten repetitions, to complete one set. (Figure 3.36)
- It is recommended to carry out each set five times a day with periods of rest in between. However, it may be noted that the greater the number of practice trials, the better.
- The same regime can be carried out with liquid and the patient can be asked to move the liquid from one cheek to the other. However, if there is posterior spillage and consequent aspiration, it is better to avoid the exercise with liquid bolus.

Note: The clinician can provide visual feedback using a mirror or a piece of paper to ensure no air escapes from the lips or the nose. This will facilitate good lip seal and also help in increasing the lip tone.

(a) *(b)* *(c)*

Figure 3.36: (a) Puffing both sides of the cheek, (b) and (c) Puffing lateral sides of the cheek.

Holding objects between lips

Materials required: Straw, tongue depressor, spoon, a pair of gloves.

- Ask the patient to relax, sit upright with mouth closed.
- Instruct the patient to place a straw between the lips for five seconds without dropping it (Figure 3.37). It is important to do so without the support of teeth.
- Gradually increase the time in steps of five seconds until thirty seconds.
- It is recommended to carry out each set five times a day with periods of rest in between. However, it may be noted that the greater the number of practice trials, the better.
- The same regime can be carried out with other objects such as tongue depressor or a spoon or objects of different sizes, textures and shapes.

Note: This also helps in building sensory awareness and lip closure

Figure 3.37: Holding objects between lips

Blowing/whistling

Materials required: Balloons, Bubbles

- Ask the patient to relax, sit upright with mouth closed.
- Provide a balloon and ask them to inflate it.
- This would encourage active stretching of the lips.

- Provide balloons of different sizes and openings in an increasing hierarchy, beginning from larger openings to smaller openings.
- Other activities such as blowing bubbles, balloons and whistling without a whistle can also be carried out.

Note: This facilitates lip closure.

Food on lips

Materials required: Yoghurt, peanut butter, ice cream stick, a pair of gloves

- Ask the patient to relax, sit upright with mouth closed.
- Apply various foods such as yogurt, peanut butter to the lips of the patient using the ice cream stick.
- Encourage them to bring the lips together and rub them against each other.

Note: This will improve lip closure and increase sensory awareness on the lips.

ii) <u>Speech tasks</u>

Production of vowels

- Instruct the patient to say /u/ and /i/ alternately as fast as possible.
- Ask them to perform the same for ten repetitions to complete a set.
- These can be three sets done in a session.
- It is recommended to carry out each set five times a day with periods of rest in between. However, it may be noted that the greater the number of practice trials, the better.

Note: Vocalization provides additional stimulation and awareness.

Production of phonemes

- Instruct the patient to produce /p/ continuously as fast as possible.
- Ask them to perform the same for ten repetitions to complete a set.
- Next ask them to produce /b/ in a similar manner.

- There can be three sets done in a session.
- It is recommended to carry out each set five times a day with periods of rest in between. However, it may be noted that the greater the number of practice trials, the better.

Note: The same can also be done alternating between different phonemes such as /pa/ and /ka/ or /ba/ and /ga/.

Production of CV syllables

- Instruct the patient to say /mae/ three times and then followed by /pae/ three times and finally /bae/ three times.
- Ask them to perform the same for ten repetitions to complete a set.
- These can be three sets done in a session.
- It is recommended to carry out each set five times a day with periods of rest in between. However, it may be noted that the greater the number of practice trials, the better.

Humming

- Ask the patient to relax, sit upright with mouth closed.
- Practice humming along with the patient.
- Cue the patient to start and stop humming.
- When humming stops, instruct the patient to open the lips and then close again.
- Perform this ten times to complete a set.
- This can be done thrice a day.

Note: This will assist lip closure.

C) <u>Strengthening exercises</u>

Holding increasing weights

Materials required: Tongue depressor, one- rupee Indian coin (Figure 3.38), a pair of gloves.

- Ask the patient to relax, sit upright with mouth closed.
- Place the tongue depressor horizontally between the patient' closed lips
- Get them to hold the same for twenty-five seconds.
- Following the same, add a coin on either side of the tongue depressor and encourage the patient to balance the same for thirty seconds.
- Continue until the patient can achieve four coins on either side of the tongue depressor. (Figure 3.39)
- Repeat this five times during a session which completes a set.
- It is recommended to carry out each set five times a day with periods of rest in between.

Note: The patient should not use their teeth to balance the tongue depressor between their lips. The coins can be pasted on either side of the tongue depressor to prevent their fall.

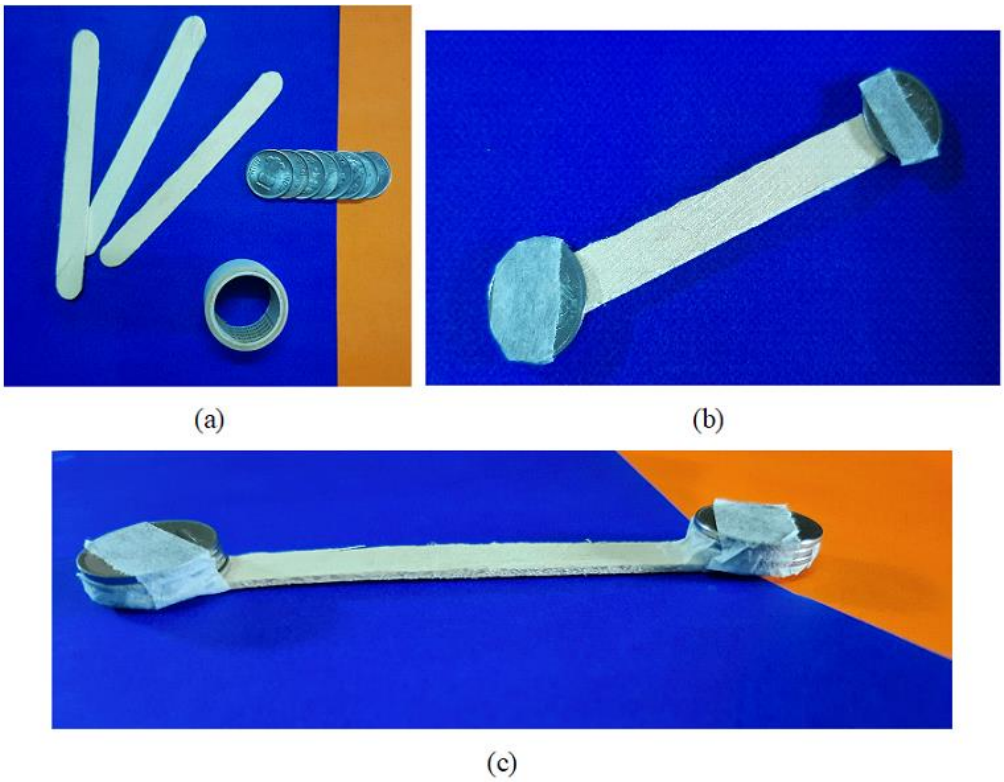


Figure 3.38: (a) Things required for the exercise, (b) Taping the coins on either side of the ice cream stick one by one, (c) Final Target should be four coins on either side of the ice cream stick.

Figure 3.39: Demonstration of the exercise

Upper Lip movement against resistance

Materials required: A pair of gloves

- Instruct the patient to open their mouth and then push the upper lip down while you have to resist the movement.
- Start with minimal force and then gradually increase upto moderate force.
- The resistance can be offered by a tongue depressor or ice cream stick. (Figure 3.40)
- Provide support on the head with the other hand.
- The same regime can be carried out for the lower lips.
- Repeat this five times during a session which completes a set
- It is recommended to carry out each set five times a day with periods of rest in between.

Figure 3.40: Upper lip movement against resistance

Upper and lower lip movement against resistance

Materials required: a pair of gloves

- Have the patient relax, sit upright and close their lips.
- Ask them to keep the lips closed while you try to gently to break the lip seal with the index finger and the thumb.(Figure 3.41)
- Start with minimal force and ten gradually increase upto moderate force.
- Provide support on the head with the other hand.
- Repeat this five times during a session which completes a set.
- It is recommended to carry out each set five times a day with periods of rest in between.

Figure 3.41: Upper and lower lip movement against resistance, the arrows indicate the direction of hand movement by the clinician

Button-thread pull

Materials required: Large button with a minimum of two holes, dental floss/ thread (Figure 3.42: (a), (b))

- Have the patient relax, sit upright and close their lips.
- Insert the thread/floss into the button.
- Place the button between the closed teeth and closed lips.
- Now, begin pulling the button forward using the thread.
- Ask the patient to hold the button in place for fifteen seconds. (Figure 3.41: (c))
- Repeat this five times during a session which completes a set.
- It is recommended to carry out each set five times a day with periods of rest in between.

Note: Initially pull the thread with minimum force and gradually increase the force.

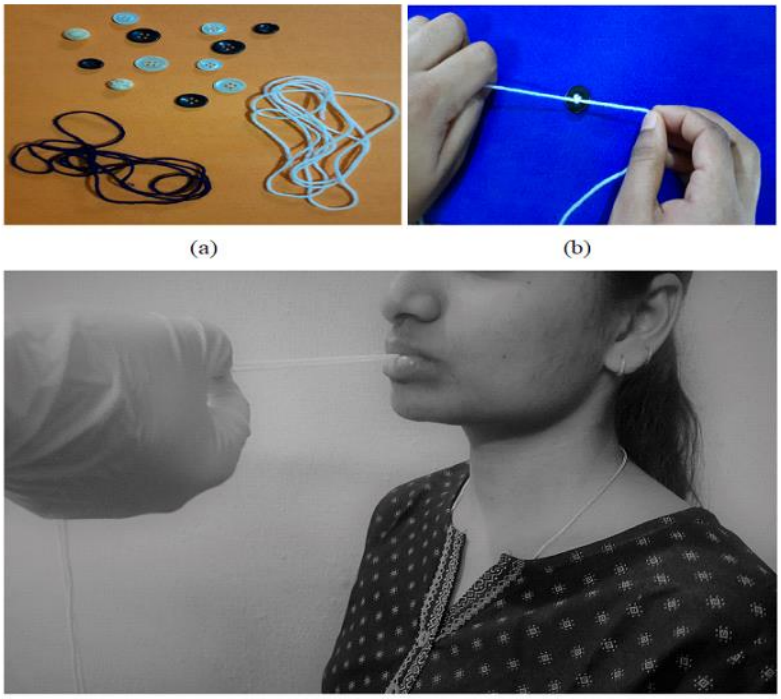


Figure 3.42: (a) Things required for the exercise, (b) Secure the button and thread with a knot, make sure the thread is long enough, (c) Demonstration of the exercise

Holding paper against straw

Materials required: Straw and paper bits.

- Ask the patient to relax, sit upright with mouth closed.
- Instruct the patient to place a straw between the lips. (Figure 3.43)
- Now, get them to suck a paper bit through the straw and hold for at least ten seconds.
- This can be repeated ten times to complete a set.
- It is recommended to carry out each set five times a day with periods of rest in between. However, it may be noted that the greater the number of practice trials, the better.

Note: If the patient cannot hold for ten seconds, begin with one second and slowly progress from that level to ten second level in 1-second steps. This facilitates lip closure.

(a) (b)

Figure 3.43: (a) Straws and paper bits required for the activity, (b) Demonstration of the technique

Tongue depressor pull

Materials required: Tongue Depressor, a pair of gloves.

- Have the patient relax, sit upright and close their lips.
- Place the tongue depressor between the lips and instruct the patient to hold it tightly.
- Pull the tongue depressor by applying minimum force for five seconds. The pull can be given laterally as shown (Figure 3.44) or placed in front and pulled outwards.
- Gradually increase the force and get them to hold for a maximum of fifteen seconds.
- Repeat this five times during a session which completes a set.
- It is recommended to carry out each set five times a day with periods of rest in between.

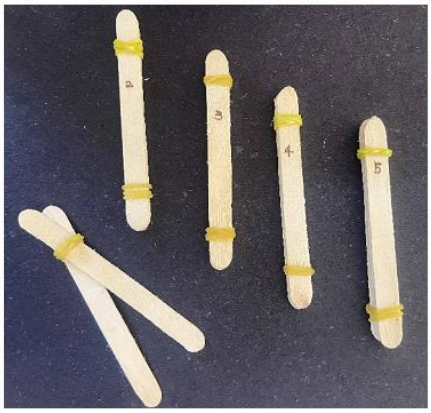
Figure 3.44: Tongue depressor pull by the lips, the arrows indicate the direction of pull

Crossbar push

Materials required: 5-7 Tongue Depressors, Silk Tape

- Stack two tongue depressors and tightly tape them together on one end only (Figure 3.45 (b))
- Make a wedge of tongue depressors with varying thickness ranging from groups of 2 until 5 (Figure 3.45 (b))
- Depending on the height of the tongue depressor wedges, it will create more or less resistance.
- Slide the tongue depressor wedges between the two tongue depressors tied at one end, as depicted in figure 3.45(a).
- Place between patient lips, anterior to teeth.(Figure 3.45 (c))
- Have patient press the extended tongue depressors together and hold for 3 seconds, then release.
- Repeat ten times to complete a set.

(a)



(b) (c)

Figure 3.45: (a) Crossbar using the 4 ice cream stick bundle, (b) Cross bar using two ice cream sticks and ice cream stick bundles of varying thickness to be placed between the cross bar, (c) Demonstration of using cross bar for lip strengthening.

Sucking of the gauze

Materials required: Gauze, a clean ball of cotton, a pair of gloves.

- Tie a thread around a gauze piece, so that it shapes like a ball.
- Place the gauze ball between the lips of the patient. (Figure 3.46)
- Secure the ball by holding the thread in your hand.
- Moisten the gauze.
- Instruct the patient to pull the moistened gauze into the oral cavity without the assistance of hands or tongue.

Figure 3.46: Gauze dipped in juice placed between lips, the client attempts to pull the gauze in without help of tongue or teeth or hands

Note: Hold the thread tight to prevent the accidental swallowing of the gauze ball

The jaw muscles may be floppy or loose resulting in improper bolus retention or containment. The exercises to strengthen the jaw have been described under the section on bolus mastication difficulties.

II EXERCISES TO IMPROVE THE ACTIVITY OF EATING AND DRINKING

Sucking exercise

- Ask the patient to suck with the tongue tip against the alveolar ridge and lips and teeth slightly apart or with teeth closed using a 'slurping' or 'suctioning' pull of the tongue to the mid palate area.
- Instruct them to do this with as much sound possible to increase sensory feedback.
- Later tell them to swallow their saliva.
- Get them to perform it for ten repetitions to complete a set.

Note: This will increase tongue palate contact and help the patient to manage saliva.

Lollipop suck

Materials required: Lollipop

- Use a lollipop and encourage the patient to suck on it.
- Focus on establishing a proper lip rounding and lip closure.
- Perform this for ten minutes.

Solid bolus

- Introduce soft solids like banana or idli.
- The focus here is to work on lip seal.
- Ask the patient to chew on the bolus, while doing so monitor the lip seal and check for anterior spillage.
- The chewing pattern should be rotatory with closed mouth.
- The exercise can be carried out only if the patient have a control over the bolus and are not under risk for aspiration.
- Carryout this regime for every meal routine.

Liquid Bolus

Materials required: a silicon or metal spoon, liquid bolus (juice or water)

- Ask the patient to be seated in an appropriate posture.
- Present the liquid bolus either through spoon or straw.
- Monitor for lip seal and lip rounding while consuming through straw. The spoon placement is shown in figure 3.43(b).
- Once the bolus is received, ask the patient to hold the bolus in the oral cavity without swallowing for 3 seconds.
- Then ask the patient to look down. Now monitor for lip seal and anterior spillage. Hold this position for 3 seconds.
- The lips should be able to retain the bolus in the oral cavity.
- For liquid bolus, the bolus mastication is by-passed and directly is propelled into the pharynx.
- Carryout this activity for every meal routine involving liquid food.

SECTION III

DIFFICULTIES WITH BOLUS FORMATION AND MANIPULATION

Recognising bolus formation and manipulation difficulties

- Poor tongue movement in different directions
- Searching movements of the tongue or inability to organize tongue movements due to apraxia of swallow
- Tongue asymmetry
- Tongue fasciculation and involuntary movements
- Difficulty in lateralizing the bolus
- Residue on the tongue or in the lingual sulcus
- Specific difficulty with solid foods
- Premature spillage of the bolus into the oropharyngeal aperture

Possible Reasons

- Reduced sensation of food/liquid in the mouth
- Weakness on one side or both side of the tongue causing reduced mobility and strength
- Weakness in the jaw
- Reduced saliva production

I EXERCISES/ACTIVITIES TARGETING UNDERLYING IMPAIRMENT

The activities mentioned below needs to be done if the tone in the tongue muscles is low.

A) Tone management

i) Quick stroking

Materials required: Ice cream stick, Cotton swab, textured brushes and a pair of gloves.

- Ask the patient to relax, sit upright with mouth open.

- Hold an ice cream stick/cotton swab between the middle of the tongue and hard palate.
- Move it across the tongue from anterior to posterior direction or vice versa.
- Use unpredictable strokes in a quick manner.
- Also, move it circularly from the middle of the tongue to the teeth on one side, back to the middle of the tongue, and then to the opposite side of the teeth in the same manner. (Figure 3.47)
- Move in each direction ten times to complete a set.
- Once achieved, progress to using textured brushes.
- It is recommended to carry out each set five times a day with periods of rest in between.

Note: If the patient shows hypersensitivity or any other acceptance issues, begin with your index finger by making the same firm and quick strokes followed by a release and then progress toward challenging textures. In case there is increased tone on the tongue, gentle and slow stroking can be carried out to inhibit spasticity.

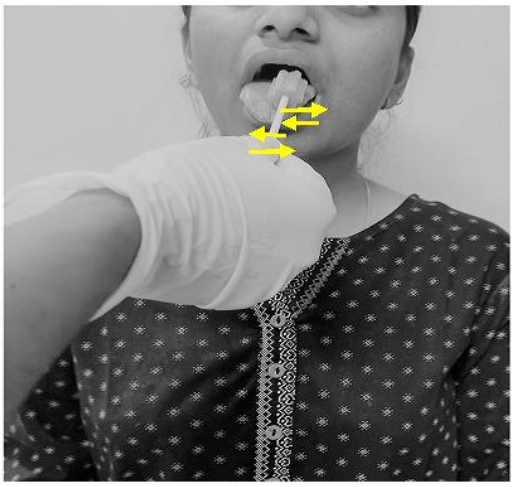


Figure 3.47: Oral swab moving from the middle to right to middle and to left side of the tongue, the arrows indicate the direction of movement

ii) <u>Sensory Stimulation</u>

Pressure and temperature stimulation

Materials required: Steel spoon, glass, ice cubes, tongue depressor, a pair of gloves.

- Place a steel spoon into a glass containing ice cubes until it turns cold.
- Ask the patient to relax, sit upright with mouth open.
- Place the cold spoon on the tip of the tongue.
- Apply light pressure and instruct the patient to lift the spoon with the tongue.
- Next, place it on the tongue blade and follow the same procedure.
- Repeat the same with the spoon on the posterior portion of tongue.
- Next, touch the palate with tongue depressor and instruct the patient to touch the area with the tongue.
- This can be repeated ten times to complete a set.
- It is recommended to carry out each set five times a day with periods of rest in between.

Note: It should be kept in mind to consistently dip the spoon in the cup every time to maintain a constant temperature throughout the set.

Cold and sour stimulation

Materials required: Lemon, tooth pick

- Prepare lemon juice and freeze it.
- While freezing, place a toothpick in the tray.
- Ask the patient to relax, sit upright with mouth open.
- Use this cold and sour bolus and move it on the tongue.
- This can be repeated ten times to complete a set.
- It is recommended to carry out each set five times a day with periods of rest in between.

  Note: This can be used to improve awareness of the tongue and other structures in the oral cavity. Clinician must keep in mind that temperature during cold stimulation must be cold enough to create oral awareness, very low temperatures can cause ice burns.

  Stimulation with foods of different taste, temperature

  Materials required: Foods of different taste and texture

- Select food that the patient likes.

- Provide that food to the patient. Ensure that the food has a strong taste or texture, which would stimulate the receptors on the tongue.
- Generally sour food items help improve the oral awareness. Food items such as sour mango or a sour candy or lemon can be provided.
- Regarding temperature, cold food such as ice popsicle increases reflexive response of the muscles thus providing increased tone.
- Use of contrasting textures can be taken up to stimulate the tongue, beginning with crispy textures like chips and then introducing smooth textures like mashed potatoes. Making sure the consistency of the spectrum does not vary.

  Note: Ensure that there is no aspiration while carrying out this activity. This can be used to improve awareness of the tongue and other structures in the oral cavity.

  Intraoral stimulation of cheeks

  Materials required: A pair of gloves, toothbrush or any other textured brush

- Ask the patient to relax, sit upright with mouth open.
- Place your finger on the inside of the cheek.
- Make strokes along the sides of the cheek as if to form the alphabet “C” from top to bottom. (Figure 3.48)
- The same can be done for the other cheek also, with 4 to five repetitions on each side.

  Note: The same can be done with toothbrush or any other textured brush or a cold object.

Figure 3.48: Stimulation by making "C" inside the cheek

B) Range of motion exercises

i) Non-speech tasks

Passive movement

Materials required: Gauze pad, a pair of gloves

- Ask the patient to relax, sit upright with mouth partially open.
- Grasp the tongue tip of the patient with a gauze.
- Move the tongue slowly in different directions such as protruding, elevating, retracting, and lateralizing the tongue.
- Get them to maintain the tongue in each position for 1 second.
- Provide head support while carrying out this exercise.
- Perform ten such stretches to complete one set.
- Three such sets can be completed in a session.

Note: In case of hypersensitivity is seen, first desensitize the oral cavity and then go ahead with this exercise.

Tongue protrusion outside the mouth

- Ask the patient to sit upright, relaxed and protrude the tongue between the lips in the front.
- Ask them to hold in that position for thirty seconds before allowing it to glide back.
- In case they are unable to do it independently, use a dry gauze to hold the tongue tightly with both hands.
- Get them to relax and repeat the same exercise ten times in a session which completes a set.
- Later instruct then to protrude for 3 to 5 seconds and bring it back to the rest position, which can again be repeated ten times to complete a set.
- It is recommended to carry out each set five times a day with periods of rest in between.

Note: If the mandible opens and closes during tongue protrusion, ask the patient to bite on a bite block or tongue depressor.

Tongue protrusion inside mouth

- Instruct the patient sit upright, relaxed and to keep a closed mouth.
- Get them to stick the tongue below, in front of the lower teeth enclosed in the mouth.
- Now ask them to hold onto the same position for thirty seconds.
- Ten repetitions of the same can be carried out in a session to complete a set.
- Later instruct them to protrude for 3 to 5 seconds and bring it back to the rest position, which can again be repeated ten times to complete a set.
- It is recommended to carry out each set five times a day with periods of rest in between.

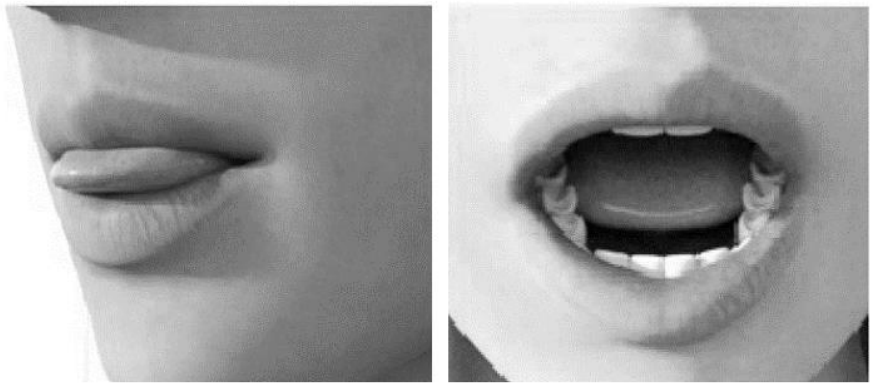
Tongue retraction

- Ask the patient to sit upright, relaxed and to retract the tongue by humping it posteriorly.
- Get them to hold for thirty seconds and bring it back to the rest position.
- Repeat this ten times during a session which completes a set.
- Later instruct them to retract for 3 to 5 seconds and bring it back to the rest position, which can again be repeated ten times to complete a set.

- It is recommended to carry out each set five times a day with periods of rest in between.

Combined retraction and protrusion

- Ask the patient to sit upright, relaxed and to protrude the tongue in the front and then retract it. (Figure 3.49)
- Get them to make consecutive tongue protrusion and retraction ten times.
- Repeat this ten times during a session which completes a set.
- It is recommended to carry out each set five times a day with periods of rest in between.

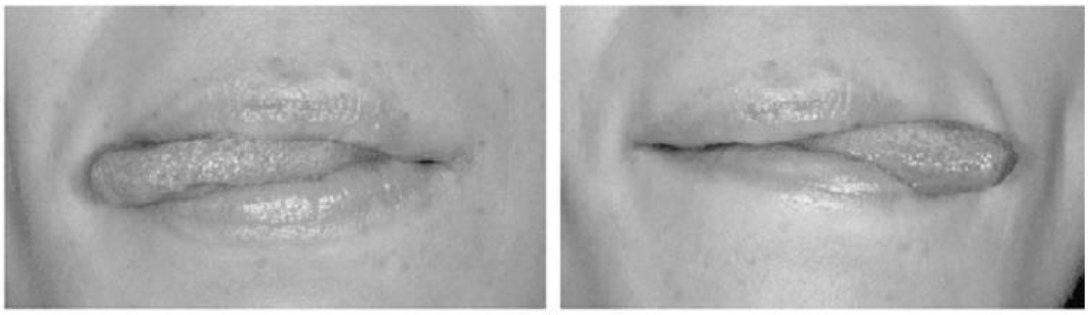


(a) (b)

Figure 3.49: (a) Tongue protrusion, (b) Tongue retraction. Taken from "Facial Action Coding System for the Tongue" by Tolby et al., in 2018.

Tongue lateralization outside the mouth

- Ask the patient to sit upright, relaxed with mouth partially open.
- Get them to protrude the tongue and move it to the right side and then to the left side to touch the corner of the mouth. (Figure 3.50)
- Get them to perform the lateral side tongue protrusion for ten repetitions.
- Repeat this ten times during a session which completes a set.
- It is recommended to carry out each set five times a day with periods of rest in between.



(a) (b)

Figure 3.50: (a), (b) Tongue lateralisation to either sides of the mouth.

Tongue lateralization inside the mouth

- Ask the patient to sit upright and relaxed.
- Instruct the patient to open the mouth as if to receive food.
- Ask them to move their tongue to either side within the mouth consecutively towards the last molar teeth for ten repetitions which completes a set.
- It is recommended to carry out each set five times a day with periods of rest in between.

Tongue elevation

- Ask the patient to sit upright and relaxed.
- Get the patient to open their mouth as wide as possible.
- Ask them to elevate the tongue at the alveolar ridge and hold for thirty seconds.
- Similarly, elevate the tongue as high as they can inside the mouth and hold onto the same position for thirty seconds.
- Get them to relax and repeat the same exercise ten times in a session to complete a set.
- Later get them to elevate the tongue for 3 to 5 secs and bring it back to the rest position for ten repetitions to complete a set.
- It is recommended to carry out each set five times a day with periods of rest in between.

Tongue curl

- Ask the patient to sit upright and relaxed.
- Help the patient find the alveolar ridge with their tongue.

- Then, ask them to curl the tongue in the posterior direction until the soft palate, continuously and hold on for thirty seconds.
- Get them to relax and repeat the same exercise ten times in a session.
- Later ask the patient to perform this sequence of movement ten times to complete a set.
- It is recommended to carry out each set five times a day with periods of rest in between.

Tongue slides

- Ask the patient to sit upright and relaxed.
- Get them to place the tongue at the top-front of the mouth right behind the teeth.
- Then instruct them to slide the tongue backwards along the roof of the mouth as far as possible.
- Then ask them to slide the tongue back to the starting position.
- Ask the patient to perform this sequence of movement ten times to complete a set.
- It is recommended to carry out each set five times a day with periods of rest in between.

Tongue movement in lateral and anterior sulcus

- Ask the patient to sit upright and relaxed.
- Instruct the patient to stretch the tongue to each side as far as possible, as if cleaning the lateral sulcus.
- Get them to hold in each lateral sulcus for thirty seconds.(Figure 3.51)
- Next get them to stretch the tongue into the anterior sulcus.
- Get them to hold in the anterior sulcus for thirty seconds.
- Repeat the same exercise ten times in a session to complete a set.
- It is recommended to carry out each set five times a day with periods of rest in between.

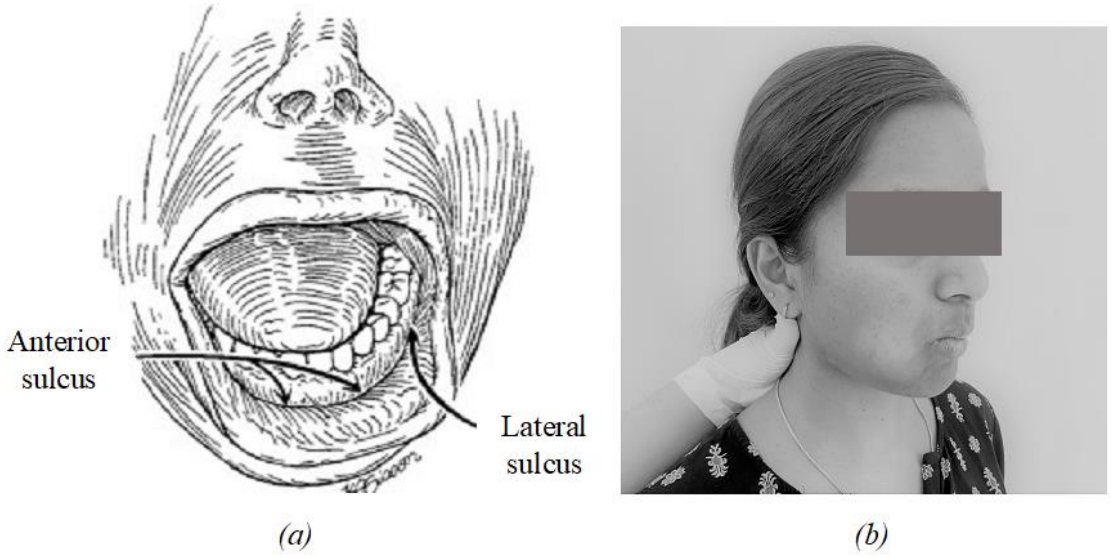


Figure 3.51: (a) Anatomic location of the anterior and lateral sulcus. Source: https://quizlet.com/188074296/anatomy-and-physiology-of-swallowing-dysphagia-exam-1-flash-cards/, (b) Demonstration of tongue movement to lateral sulcus.

Tongue movement on lips

- Ask the patient to sit upright and relaxed.
- Instruct the patient to open the mouth as if to receive food.
- Ask them to touch the centre of the upper lip with the tongue and hold it in the position for thirty seconds.
- Next, ask them to touch the centre of the lower lip with the tongue and hold it in the position for thirty seconds.
- Get them to relax and repeat the same exercise ten times in a session.
- Later, ask them to move their tongue around the lips in a circle as quickly and completely as possible.
- Ensure that they touch all areas of lips.
- Get them to perform this for ten repetitions.
- Repeat this five times during a session which completes a set.
- It is recommended to carry out each set five times a day with periods of rest in between.

Tongue tip on nose

- Ask the patient to sit upright and relaxed.
- Instruct the patient to open the mouth as if to receive food.
- Ask them to move their tongue upwards and touch the nose with the tongue tip.
- Hold it in this highest position for thirty seconds.
- Get them to perform this for ten repetitions which completes a set.
- Later ask them to touch the nose with the tongue repeatedly for ten times to complete a set. Each time they can be instructed to pause for 3 to 5 seconds.
- Repeat this five times during a session.
- It is recommended to carry out each set five times a day with periods of rest in between.

Note: It should be kept in mind that even some normal individuals cannot touch their tongue tip to nose. The focus here should be to exercise the tongue in that particular manner. It is acceptable if the patient cannot touch their nose with their tongue.

ii) Speech tasks

Production of lingual CV syllables

- Instruct the patient to alternately and continuously say /t/ and /d/ as fast as possible. This would facilitate rapid contact and release of the tongue tip to the alveolar ridge.
- Use the "ch" sound to improve tongue contact to the middle of the soft palate. Similarly, the sound "s" and "ch" help with lateral contact of the tongue to palate as well as help to groove the tongue.
- Use the /k/ and /g/ phonemes to increase posterior tongue to soft palate contact.
- Next instruct the patient to alternately and continuously say "ta-ka" or "cha- ka" as fast as possible. This is helpful to improve the sweeping motion of the tongue.
- Get them to perform ten repetitions.
- Repeat this five times during a session which completes a set.
- It is recommended to carry out each set five times a day with periods of rest in between.

Note: Other lingual sounds such as /l/ can also be incorporated.

Production of tongue trills

- Instruct the patient to continuously say “trr…” or “drr…” or “krr…”
- Get them to perform ten repetitions.
- Repeat this five times during a session which completes a set.
- It is recommended to carry out each set five times a day with periods of rest in between.

C) <u>Strengthening exercises</u>

Pressing a tongue depressor

Materials required: Tongue depressor, a pair of gloves.

- Ask the patient to sit upright, relaxed with their mouth open.
- Place a tongue depressor between their tongue and the hard palate.
- Instruct the patient to press the tongue depressor against the palate.
- Get them to perform this ten times to complete one set.
- It is recommended to carry out each set five times a day with periods of rest in between.

Tongue push up

Materials required: Tongue depressor, spoon, or ice cream stick.

- Instruct the patient to stick out the tongue as far as they can.
- Then, place a flat object like a spoon, tongue depressor or ice cream stick on the tongue.
- Get the patient to push up against the object for fifteen seconds.
- Start with minimal force and then gradually increase upto moderate force.
- Provide support on the head with the other hand.
- Repeat this five times during a session which completes a set.
- It is recommended to carry out each set five times a day with periods of rest in between.

Tongue Push Downs

Materials required: Tongue depressor, spoon, or ice cream stick, a pair of gloves.

- Instruct the patient to stick out the tongue as far as they can.
- Then, place a flat object like a spoon, tongue depressor or ice cream stick underneath the tongue.
- Instruct them to push down on the spoon with the tongue for fifteen seconds.
- Provide support on the head with the other hand.
- Repeat this five times during a session which completes a set.
- It is recommended to carry out each set five times a day with periods of rest in between.

Tongue outward push

Materials required: Tongue depressor, spoon, or ice cream stick, a pair of gloves.

- Instruct the patient to stick out the tongue as far as they can.
- Then, place a flat object like a spoon, tongue depressor or ice cream stick on the edge of the tongue and apply pressure inwards.
- Get the patient to push outwards against the object for fifteen seconds.
- Start with minimal force and then gradually increase upto moderate force.
- Provide support on the head with the other hand.
- Another exercise that serves the same purpose would be to ask the patient to close their mouth and place a toothete between the teeth, now ask them to push the toothete outside the mouth.
- Repeat either of these exercises five times during a session which completes a set.
- It is recommended to carry out each set five times a day with periods of rest in between.

Tongue sideward push

Materials required: Tongue depressor, spoon, or ice cream stick and

- Instruct the patient to stick the tongue out towards the left side as far as they can.
- Then, place a flat object like a spoon, tongue depressor or ice cream stick on the side of the tongue and apply pressure towards the center.
- Get the patient to push against the object for fifteen seconds.
- Start with minimal force and then gradually increase upto moderate force.
- Get them to perform this five times to complete one set.
- It is recommended to carry out each set five times a day with periods of rest in between.

Holding tongue on cheek

Materials required: A pair of gloves.

- Place your finger against the right cheek of the patient, around 1 inch away from the face.
- Ask the patient to push the tongue from the inside to the cheek until they feel the hand. Get them to push as much as they can. (Figure 3.52 (a))
- Hold it for five to ten seconds.
- Relax and repeat five times for each side of the mouth unless instructed otherwise.
- Do the same for the left cheek.
- Later offer resistance by pushing against the tongue using the finger on the right cheek for fifteen seconds. (Figure 3.52 (b))
- Repeat this for the left cheek.
- Get them to perform this five times to complete one set.
- It is recommended to carry out each set five times a day with periods of rest in between.

(a) (b)

Figure 3.52: (a) Placement of hands an inch away from client's cheeks, (b) Pushing the tongue until the hand is felt

II EXERCISES TO IMPROVE THE ACTIVITY OF EATING AND DRINKING

Candy manipulation

Materials required: Sour candy, a pair of gloves

- Introduce the candy to the patient's mouth while holding one side of the candy.
- Hold the candy between the tongue and the hard palate.
- Get the patient to manipulate the candy from one side of the mouth to another and from front to back of the oral cavity.
- Get them to perform this ten times to complete one set.

Note: Once adequate amount of manipulation us achieved, use gauze with a string attached, begin with small bolus sizes, and take up the same sequence.

Lingual sweep

- Provide a soft solid bolus and instruct the patient to manipulate and chew.
- Later permit them to swallow it.

- Instruct the patient to use tongue purposefully to sweep the entire oral cavity, particularly the areas of weakness, to collect residual bolus and redirect to the middle part of the tongue for development of a bolus.
- Get them to do this throughout the meal after every bolus is swallowed.

Note: This is done to use the tongue to clear residue from oral cavity. A mirror can be placed on the meal tray to provide visual feedback to the patient. When the oral sensitivity is decreased and they are not aware of the residue, a reminder can be provided to carry out the lingual sweep.

Manipulation of gauze with liquid bolus

Materials required: Gauze, fruit juice

- Make a gauze ball and tie it to a string and dip into any fruit juice.
- Hold on to the string and place the gauze ball inside the patient's mouth.
- Get them to push the gauze ball upward and backwards to extract the juice out.

Note: This is carried out only if the patient can tolerate small amounts of liquid without the risk of aspiration. Also ensure that you hold the string of the gauze ball tightly.

Manipulation of gauze with solid bolus

Materials required: Soft solid bolus

- Make a bag by stitching three sides of a gauze piece.
- Insert the soft solid bolus and tie the bag to a string.
- Hold on to the string and place the gauze bag inside the patient's mouth, on the mid portion of the tongue.
- Get them to push the gauze ball to between the molars, chew a little on one side and then shift to the molars on the other side and then chew again.
- Later introduce bolus without the bag and instruct the patient to perform the same movements with the tongue.

  Note: Ensure that you hold the string of the gauze bag tightly to prevent accidental swallowing.

SECTION IV

DIFFICULTIES WITH BOLUS MASTICATION

Bolus mastication difficulties occur, when the bolus between the molars cannot be masticated or chewed into a fine paste before swallowing. Adequate jaw mobility and strength would prevent this.

Recognizing bolus mastication deficits

- Difficulty in biting hard textured food
- Difficulty in chewing
- Decreased rotary movement of the jaw
- Fatigue while eating solid food
- Able to take only liquid/pureed feeds due to difficulty in chewing
- Clenching of jaw
- Drooping jaw
- Difficulty in speaking clearly
- Discomfort performing activities such as blowing and sucking
- Decreased dentition or poor fitting dentures

Possible reasons

- Weakness in the lower jaw which leads to poor jaw mobility and strength
- Reduced saliva production

I EXERCISES/ACTIVITIES TARGETING UNDERLYING IMPAIRMENT

This subsection includes exercises to increase the tone of the mandible and enhance jaw mobility, which will facilitate mastication

A) Tone management: The activities mentioned below needs to be done if the tone in the jaw muscles is low. Sensory stimulation methods such as massage, stroking/tapping, thermal stimulation and vibration can be used to alter the tone.

i) Tapping: Tapping is one of the ways to increase the tone.

Materials required: A pair of gloves.

- Ask the patient to relax and sit in the upright position, with the mouth closed.
- Tap on the masseter with fingers in a rhythmic manner with the finger tips.
- Begin from the origin of the muscle and go upto the insertion of the muscle.
- Provide head support while carrying out this exercise.
- Perform the tapping ten times to complete a set.
- Perform this thrice every day.
- Follow the same regime for the temporalis muscle.

ii) <u>Quick stretch</u>

Materials required: A pair of gloves.

- Ask the patient to relax, sit upright with mouth closed.
- Carry out quick stretching using a gloved finger.
- Use the thumb and the index finger on the masseter, medial pterygoid and temporalis and apply firm directed pressure in the direction of the origin and insertion of the muscles slowly one at a time (Figure 3.8 (b) and (c)).
- Provide head support while carrying out this exercise.

  Note: The speed of providing stretches is important. Slow stretches can reduce the tone, while quick or sudden stretches increase the tone.

  Gold fish exercise

  Materials required: A pair of gloves.

- Ask the patient to press their tongue against the roof of the mouth.
- Place your index finger on their TMJ (Temporo Mandibular Joint) and the other on their chin.
- Now ask them to lower their jaw as much as they can with mouth closed and ask to hold onto the position for thirty seconds.

- Here the index finger helps monitor the movement at the TMJ, whereas the other index finger helps assist them to lower the jaw in a slow manner.
- Carryout this thrice a day.

iii) <u>Quick stroking</u>

Materials required: Toothbrush, a pair of gloves.

- Begin brushing the temporalis muscle and the masseter along their origin to insertion.
- Use quick and brisk strokes with the brush.
- If the patient is aversive to brush, then begin with a gloved finger and later progress to textured objects.
- Carryout this stroking for at least 15 times.

Note: While doing so, make sure that the stroking is tolerable; in case of hypersensitivity, begin with hands and then progress to textured materials.

iv) <u>Sensory stimulation</u>

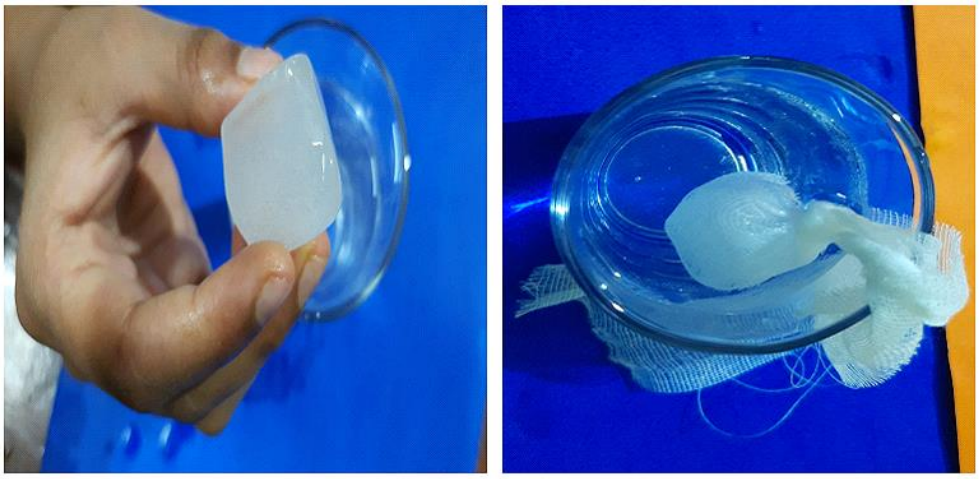
Massaging the mandible with ice

Materials required: Ice cube, handkerchief, a pair of gloves.

- Wrap an ice cube in a handkerchief.
- Massage the muscles of the mandible by stroking the muscle along the direction of orientation of the muscle with adequate pressure.
- First target the temporalis, then massage the masseter in a similar manner.
- Massage each muscle for a duration of ten to fifteen minutes.

Note: Place the ice cubes in a cup of room temperature water for a while, which will remove any sharp edges in the cube, preventing any potential harm. Also make sure to wipe the area with a dry, room temperature cloth or cotton ball after massage, to prevent any ice burns. (Figure 3.48)

Note: Hot stimulation using hot bags or cloth is mostly used for patient experiencing pain in locked jaw or TMJ pain.



(a) (b)

Figure 3.53: (a) Ice cubes with smoother edges after being dipped in water, (b) Ice cubes wrapped in gauze cloth

B) <u>Range of motion exercises</u>

The exercises mentioned in the section I can be carried out to increase the jaw mobility. In addition the following exercises can also be done.

i) <u>Non-speech tasks</u>

Breathing with mouth closed

- Ask the patient to sit upright, relaxed with mouth closed.
- Instruct patient to practice inhaling and exhaling through the nose rather than mouth.
- Provide a mirror so that they can watch the closed lips with a mirror.
- Get them to perform this for ten repetitions to complete a set.
- It is recommended to carry out each set three times a day with periods of rest in between**.**

Munching

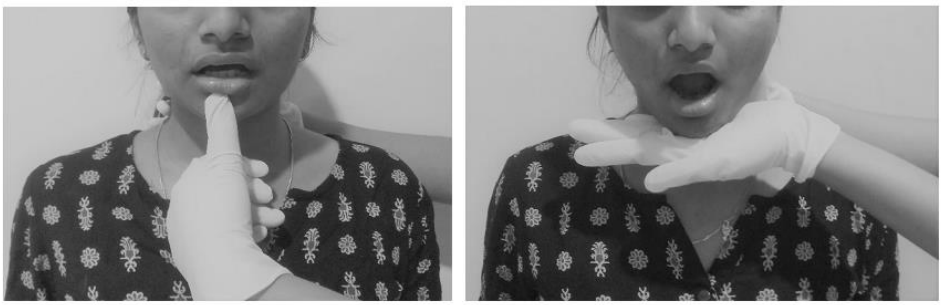
- Instruct the patient to practice a facial squeeze by squeezing lips together.

- While keeping lips closed, ask them to alternate bringing teeth together and separating them, which mimics chewing activity.
- Get them to perform this for ten repetitions to complete a set.
- It is recommended to carry out each set three times a day with periods of rest in between**.**

C) <u>Strengthening exercises</u>

Jaw opening against resistance

- Get the patient to sit upright, relaxed with their mouth open wide.
- Place your hand a little below their mandible.
- Offer resistance by pushing the jaw with the palm, while the patient are instructed to sustain the open jaw for five seconds. The patient needs to try to build resistance against your hand (Figure 3.54(a)).
- The duration can be extended to fifteen seconds or until the patient feels fatigue of the mandibular muscles.
- It is best to provide head support.
- Another way of achieving the same effect would be to instruct the patient to open the mouth against this resistance. When the resistance is opposite to the direction of movement, it allows for the gradual stretching of the jaw muscles as shown below (Figure 3.54 (b)).
- Get them to perform for five repetitions of either of the exercises to complete a set.
- It is recommended to carry this three times a day.



(a) *(b)*

Figure 3.54: (a) Jaw opening resisted by upward movement of the palm, (b) Providing resistance with index finger against the jaw opening

Jaw lateralization against resistance

- Keep your fingers steady and a little away from the jaw towards either right or left.
- Now, ask the patient to slide their jaw towards the same side and stop where the fingers are present. (Figure 3.55)
- Gently resist the jaw movement with the fingers and hold the same for two seconds.
- Instruct the patient to hold it in the same position, while you try and move it to the centre position.
- Use minimal force and then gradually increase upto moderate level.
- Get them to sustain the lateral jaw posture against resistance for five seconds.
- Get them to perform five repetitions to complete a set.
- It is recommended to carry this three times a day.

Figure 3.55: Lateral jaw movement against resistance

Biting down on ice-cream sticks with molars

Materials required: Ice-cream sticks, a pair of gloves.

- Place one ice-cream stick between the molars on the right side.
- Ask the patient to bite the blocks for a beginning duration of seven seconds.
- For symmetrical weakness, blocks of the similar size used on both sides.
- The ultimate goal would be to reach a target of fifteen seconds.
- Ten repetitions can be performed in a session to complete a set.
- It is recommended to carry out each set three times a day with periods of rest in between.

Note: The size of the bite block can be increased gradually, by adding two, three and four ice-cream sticks to the pile. They can be bundled together using a rubber band. If the patient finds it hard to bite the block, you can manually guide them to close the jaw. This support can be gradually withdrawn. (Figure 3.56)

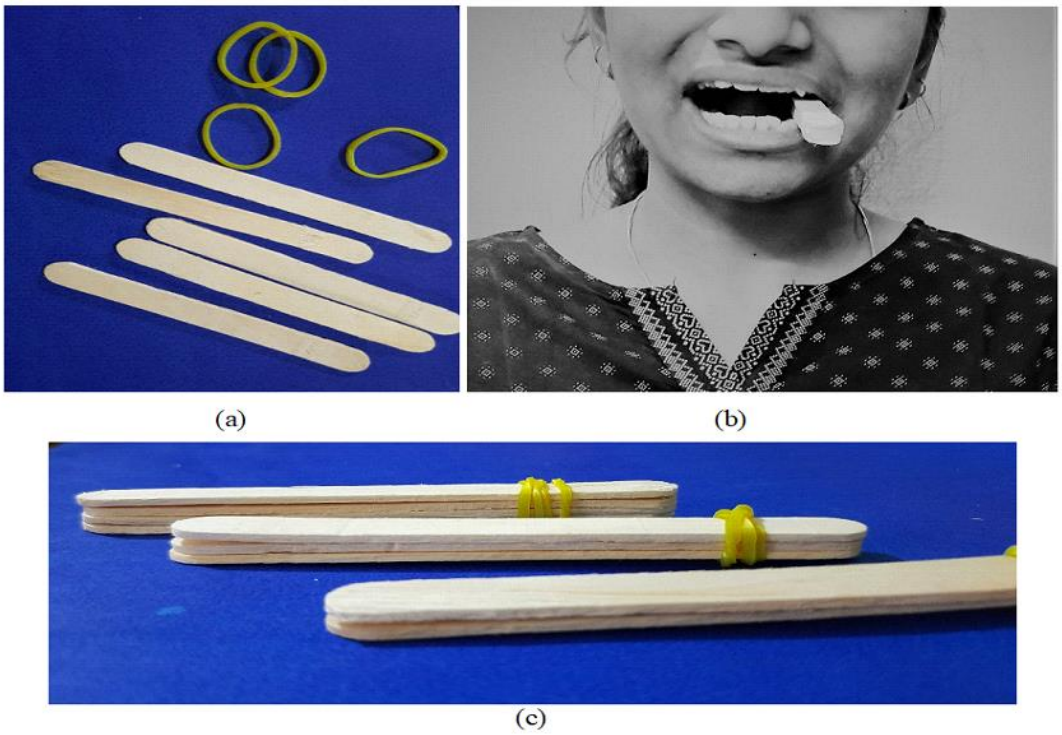


Figure 3.56: (a) Items required for the exercise, (b) Demonstrating use of bite block, (c) Bite blocks of increasing width.

Biting down on ice-cream sticks with front teeth

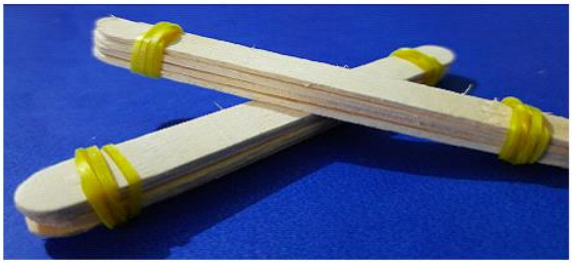
Materials required: Ice-cream sticks, a pair of gloves.

- Instruct the patient to hold the ice cream stick bundle in between the front teeth. (Figure 3.57)
- Ask them to slide the mandible forward, keeping the closed mouth posture such that the bundle rests in the same place.
- Assist the patient only if the bundle goes out of place.
- Get them to hold this position for fifteen seconds.
- Ten repetitions can be performed in a session to complete a set.

- It is recommended to carry out each set three times a day with periods of rest in between**.**

Note: The size of the bite block can be increased gradually, by adding two, three and four ice-cream sticks to the pile. They can be bundled together using a rubber band.

(a)



(b)

Figure 3.57: (a) Demonstration of use of ice cream stick bundle, (b) Ice cream stick bundle

II. EXERCISES TO TARGET THE ACTIVITY OF EATING AND DRINKING

Munching candy

Materials required: Sour soft candy

- Place the candy between the molars and ask the patient to alternatively open and close the mouth.
- This opening and closing should be strong enough to mush the candy.
- The patient should be able to do the same for ten repetitions.

Chewing on a gum

- Introduce the chewing gum and ask the patient to chew through the gum.
- Provide support under the jaw to initiate the chewing movements.
- Ensure that they are swallowing the saliva as well frequently.
- Carry out the exercise for at least two to three minutes.

Note: In case the patient has aspiration, ensure that this is cleared first before moving on to this exercise.

Chewing on gauze with food

Materials required: Soft solid bolus, a gauze cloth.

- Make a bag by stitching three sides of a gauze piece.
- Insert the soft solid bolus and tie the bag to a string.
- Hold on to the string and place the gauze bag inside the patient's mouth between the molars.
- Get them to chew a little on one side and then shift to the molars on the other side and then chew again.
- Later introduce bolus without the bag and instruct the patient to perform the same movements with the tongue.

Note: Ensure that you hold the string of the gauze bag tightly to prevent accidental swallowing. The bolus bag can also be made by securely tying the bolus within the gauze cloth to make a bag as shown in figure below.

Figure 3.58: A bolus bag secured with a knot, with a soft solid bolus inside.

SECTION V

DIFFICULTIES WITH BOLUS PROPULSION

If the bolus is not pushed into the pharynx after chewing due to poor weakness in the sequential elevation of the anterior, middle, and dorsal regions of the tongue, it leads to propulsion difficulties. Adequate mobility and strength in the tongue would prevent this.

Recognizing bolus propulsion deficits

- Repeated back and forth movement of the tongue (Lingual rocking)
- Tongue pumping to initiate swallow
- Forward tongue movement to start the swallow due to tongue thrust
- Inability to move the tongue posteriorly
- Involuntary movements in the tongue
- Uncoordinated tongue movements during bolus propulsion
- Incomplete tongue-to-palate contact due to reduced tongue elevation
- Adherence of food to hard palate
- Piecemeal deglutition
- Poor sensation in the oral cavity
- Residue collected on the tongue or in the lingual sulcus post- swallow

- Unable to move the saliva/secretions posteriorly to swallow backwards causing
- Appearance of excessive saliva

Possible reasons

- Weakness in the tongue which leads to poor mobility and strength

I EXERCISES/ACTIVITIES TARGETING UNDERLYING IMPAIRMENT

This subsection includes exercises to enhance posterior tongue mobility and strength, which will facilitate bolus formation and manipulation.

A) Tone management

i) Massage

Materials required: A pair of gloves, toothbrush or any textured brushes.

- Use circular massage using gloved fingers to stimulate the posterior region of the tongue for ten to fifteen seconds.
- Beginning from the anterior portion, move slowly to the posterior part.
- Later repeat the same with a toothbrush or any textured brushes and do the same massage for ten to fifteen seconds.
- This can be carried out three times in a session.

Note: This would decrease the tone in the posterior part of the tongue. If there is no gag reflex, then the exercise can be done.

ii) Stroking:

Materials required: a pair of gloves, toothbrush.

- Ask the patient to open their mouth and protrude their tongue to a comfortable extent.
- Once done, use the tooth brush to make quick strokes from anterior to posterior, then posterior to anterior.
- The stroking should also be done laterally towards the right and left of the tongue blade.
- Carryout this activity for 15 times.

- This exercise can be done thrice a day.

Note: Observe for gag reflexes when stroking the posterior tongue portion and also if the patient shows hypersensitivity, then begin with gloved finger and proceed to toothbrush or other textured objects.

iii) <u>Sensory stimulation</u>

Cold stimulation of soft palate

Materials required: Small metal spoon and cup of ice

- Chill the spoon in the cup of ice.
- Now, place the spoon in the patient's mouth.
- Begin with strokes to the soft palate and anterior faucial pillars slowly, avoiding gag reflex.
- You can also alternatively present hot and cold of stimuli (hot spoon and a cold spoon) as shown in figure 3.58.
- Do the same for ten times to complete one set.
- This can be done three times a day.

Figure 3.59: Stimulation of the velum with a cold spoon

B) **<u>Range of motion exercises</u>**

i) <u>Non- speech tasks</u>

Forced tongue sucking against palate

- Instruct patient to sit upright, relaxed with mouth closed.
- Ask the patient to hold their tongue upward against the palate as if they are going to suck and hold contact in this position for thirty seconds.
- This can be performed ten times to complete one set.
- It is recommended to carry out each set three times a day with periods of rest in between**.**

Tongue back elevation

- Instruct patient to sit upright, relaxed with mouth closed.
- Ask the patient to elevate the back of tongue as far as possible, hold it for 1 second and release.
- Later ask them to hold contact in this position for thirty seconds.
- This can be performed ten times to complete one set.
- It is recommended to carry out each set three times a day with periods of rest in between**.**

Tongue sweep

- Instruct patient to sit upright, relaxed with mouth closed.
- Ask the patient to hold the tongue on the alveolar ridge.
- Next ask them to sweep posteriorly against the palate with their tongue.
- Get them to perform for ten repetitions to complete a set.
- It is recommended to carry out each set three times a day with periods of rest in between**.**

Back of tongue retraction

- Instruct patient to sit upright, relaxed with mouth partially open.
- Instruct the patient to protrude the tongue between the lips and stick it out as far as possible; get them to hold onto the same position for up to seven seconds.
- Next instruct them to retract the posterior portion of the tongue to the roof of the mouth, as in producing /k/ and ask them to hold onto the same for seven seconds

- Once the patient can get hold the above, get them to the sequence of movements together and perform the same for ten repetitionsto complete a set.
- It is recommended to carry out each set three times a day with periods of rest in between.

Masako manoeuvre

- Instruct patient to sit upright, relaxed with mouth partially open.
- Instruct the patient to protrude the tongue.
- Get them to bite it with the front teeth and keep it in the same place.
- Now ask them to swallow, with the tongue between the teeth.(Figure 3.59)
- This can also be guided, by holding the patient's tongue using gauze cloth.
- It is recommended to carry out each set three times a day with periods of rest in between.

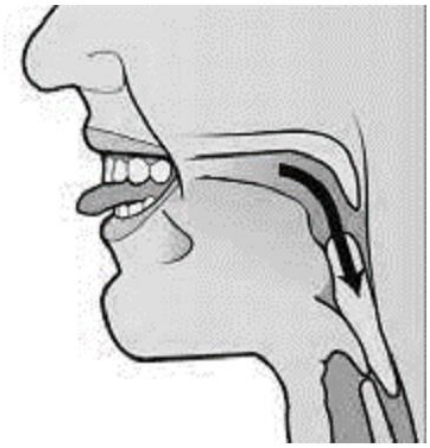


Figure 3.60: Demonstration of the masako manoeuvre. Taken from "Role of physical therapy in the management of orofacial cancer" by Fernandes et al., in the year 2018.

Gargle

- Instruct patient to sit upright, relaxed with mouth wide open.
- Pretend that you are performing a gargling action and ask the patient to imitate you.
- Instruct them to move the tongue at the back, as far as possible.
- Carry this out ten times in a session.
- Provide feedback through a mirror or video recordings.
- It is recommended to carry out each set three times a day with periods of rest in between.

Yawn

- Ask the patient to initiate a voluntary yawn or get them to pretend a yawn, which pulls the tongue back.
- Get them to hold onto this tongue back position for fifteen seconds.
- They should be able to feel the stretch of the soft palate during the same.
- Carry this out ten times in a session.
- It is recommended to carry out each set three times a day with periods of rest in between.

Effortful swallow

- Instruct patient to sit upright, relaxed with mouth closed.
- Instruct the patient to imagine as if swallowing a large bolus and perform the swallow. This increased tension at the tongue will elicit a better bolus propulsion
- While performing the same, get them to feel the pressure exerted on the posterior tongue.
- Carry out this for ten repetitions to complete a set.
- Ensure that they relax after every trial.
- It is recommended to carry out each set three times a day with periods of rest in between**.**

ii) <u>Speech tasks</u>

Production of back vowels

- Instruct patient to sit upright and relaxed.
- Ask them to say any back vowel like /u/.
- Get them to articulate the same for ten repetitions to complete one set.
- There can be a total of five trials in a session.
- It is recommended to carry out each set five times a day with periods of rest in between.

Note: The use of /a/ alternatively along with /u/ would increase the posterior tongue movement, along with increasing the elevation of velum, which also occurs simultaneously with bolus propulsion.

Production of 'gu' syllable

- Instruct patient to sit upright and relaxed.
- Ask them to say the 'gu' syllable.
- Get them to articulate the same for ten repetitions to complete one set.
- There can be a total of five trials in a session.
- It is recommended to carry out each set five times a day with periods of rest in between.

Hawk manoeuvre

- Instruct patient to sit upright and relaxed.
- Instruct the patient to produce words with/k/ in the final position, such as 'hawk', 'park', 'stock', 'shock', 'pick' etc.
- Ensure that they produce the words in a clear and steady voice with comparatively increased loudness than the patient' typical voice.
- Carry out the activity with twenty words in each session.

Production of lingual CV syllables

- Instruct patient to sit upright and relaxed.
- Instruct the patient to alternately and continuously say /k/ and /g/ as fast as possible. This would facilitate posterior tongue to soft palate contact.
- Next instruct the patient to alternately and continuously say "ta-ka" or "cha- ka" as fast as possible. This is helpful to improve the sweeping motion of the tongue.
- Get them to perform ten repetitions which completes a set.
- It is recommended to carry out each set five times a day with periods of rest in between.

C) <u>Strengthening exercises</u>

Tongue back elevation against resistance

Materials required: Tongue depressor or ice cream stick, a pair of gloves.

- Instruct the patient sit upright, relaxed with mouth open wide.

- Introduce a tongue depressor towards the posterior region of the mouth.
- Ask the patient to produce sounds /k/ or /g/ or any sound with posterior tongue movement. The principle here is to move the posterior part of the tongue.
- While doing so, offer a slight resistance against the tongue movement with the tongue depressor.
- This can be carried out for ten repetitions to complete a set.
- It is recommended to carry out each set five times a day with periods of rest in between.

II EXERCISES TARGETING THE ACTIVITY OF EATING AND DRINKING

Posterior propulsion of gauze with liquid

Materials required: A long piece of gauze, fruit juice, a pair of gloves.

- Dip the gauze ball tied with a string in fruit juice.
- Place the long piece of gauze ball at the midline of the tongue.
- Ask them to push the ball upward and backwards with the tongue.
- This would, in turn, squeeze the juice from the gauze and ensure bolus propulsion.

Sour bolus propulsion

Materials required: Sour candy, a pair of gloves.

- Introduce the sour candy towards the back of the tongue.
- Now ask the patient to push the candy against the palate.
- The anterior to posterior movement of the tongue results in the propulsion of the bolus.
- This can be done when the patient has bolus control but still has not begun oral feeding yet. So after the activity the patient can be asked to spit the bolus out.
- This can be done for a duration of 10 minutes in a session.

Note: The sourness of the candy creates an oral awareness and stimulates muscle to initiate the swallow.

CHAPTER IV

ORAL HYGIENE AND ITS MAINTAINANCE

Oral hygiene is the practice of keeping the mouth, teeth, tongue and gums clean and healthy, free from disease and other problems. Oral hygiene has an impact on the overall health of an individual and can lead to many disease conditions. Poor oral health has been associated with chest infections, heart conditions, stroke and diabetes. It can also impact people's ability to eat and drink and can lead to soreness, bad breath and social embarrassment.

Oral care is particularly important for individuals who have dysphagia. Patients who are nil by mouth or on limited oral intake are at increased risk of poor oral hygiene. For hospitalised individuals who are dependant for feeding, the risk of pneumonia and other infections is greater. The oral cavity serves as a host for multiple microorganisms, including the ones that may be responsible for pneumonia. While performing the swallowing assessment with different boluses in individuals with pharyngeal dysphagia, these microorganisms can enter the lungs, if aspirated, leading to pneumonia. In those with dysphagia associated with xerostomia, the thick saliva, which serves as a medium for microorganisms to multiply, can be easily aspirated, leading to pneumonia. Thus, maintenance of oral hygiene is essential as it plays a significant role in preventing aspiration pneumonia and as speech-language pathologists (SLPs), we must ensure oral hygiene in our patients. SLPs need to counsel patients on the importance of maintaining oral hygiene and suggest possible oral care methods. They also need to make necessary referrals to dentists and dieticians, whenever necessary.

During the assessment, an SLP should assess the oral hygiene status. It can be done by use of some standardised tests available. THROAT is test that was developed by Dickinson et al. in 2001. It assesses the oral health and status in nine subsections that is rated on a 4-point likert scale. The subsections include lips, teeth, gums, mucous membrane, palate, tongue, floor of mouth, smell and saliva. Another widely used tool is the Oral Health Assessment Guide (OHAG) initially given by Eilers et al. in 1988, which consists of 8 items. It was developed to assess oral health post chemotherapy and

radiotherapy in cancer patients at rehabilitative centres. However, a study by Anderson et al. in the year 2002 provided a revised version referred to as the 'Revised Oral Assessment Guide' [ROHAG]. This also consisted of 8 items, but modifications were made under the categories of lips, mucous membrane, teeth and gums. It is used for assessment of oral health in elderly and in post-stroke, radiotherapy and chemotherapy population. The OHAG is more widely used as it caters to a wider population.

Signs of healthy mouth: A healthy mouth looks clean and moist. The lips, tongue and roof of the mouth should be pink. There should be no sign of decay or red/white patches. If the patient has dentures, these should fit properly.

Signs of Unhealthy mouth: These include dryness due to a lack of saliva, gum disease (redness, inflammation, bleeding), oral thrush/candida (a white coating), excessive drooling, mouth ulcers and dental decay.

During management of speech and swallowing problems, it is essential to counsel the patient and the caregivers regarding the importance of maintenance of oral hygiene. Here are a few tips that SLPs can use while counselling patient and the caregivers on oral hygiene.

1. In case the patient has motor issues, proper positioning is essential during brushing of teeth. The recommended position for oral care is the head and body at 30 to 45 degree upright. A seated position fully upright with good head support will be ideal. If the person is lying down, try to raise or tilt their head very carefully to one side, using extra pillows. An elevated side-lying position helps prevent aspiration during mouth cleaning. Swallowing with chin lowered seating position is safer.
2. It is important to clean the teeth using toothbrushes with soft bristles twice a day in order to remove dental plaques and food debris.
3. An electronic toothbrush will help patients who have difficulty in moving hands and arms during brushing. Timers are also available in these brushes to monitor the time.
4. They can use a fluoride toothpaste that does not foam.
5. The area in between teeth can be cleaned using dental floss or interdental brush.

6. Individuals having poor oral control with difficulty in expectoration, an oral swab or dampened gauze can be used.
7. Mouthwash can be used to remove food particles left after brushing and flossing. However for individuals with dysphagia, use of mouthwash is not advisable.
8. Chlorhexidine Gluconate gel or spray can be used around the gums, tongue and cheeks, twice a day.
9. If they have no teeth, tell them to brush gums with a moist, small, soft toothbrush twice a day. Also Chlorhexidine Gluconate gel or spray can be used twice daily to massage around the teeth, gum margins, tongue, cheeks and palate.
10. In case they are using dentures, instruct them to keep it clean by brushing twice a day. Cleaning dentures is to be done with denture brush or toothbrush, a mild soap and water. Regular toothpaste should not be used as it is too abrasive for the dentures surface. Also, instruct them to remove and soak them at night in water, in addition to brushing.
11. For individuals with xerostomia, wet the mouth every 2-3 hours with a small, soft toothbrush using clean water/saline. Apply water based moisturiser every 2-3 hours to the lips and inside the mouth. This will help keep the mouth moist.
12. In case of locked jaw or clenching, mouth prop can be used. To improve access to the whole mouth, ask the person to bite down on a second toothbrush.
13. If the patients are unable to spit, a damp non fraying gauze can be used to remove excess toothpaste and debris.
14. If the mouth is particularly 'dirty' or there is gum bleeding, the toothbrush can be dipped in chlorhexidine mouthwash or gel and can be applied to the teeth and soft tissues.
15. Individuals who have severely impaired swallow function, who are nil-by-mouth; have very dry mouths, leading to in the build-up of dried saliva secretions on the soft tissues, more so on the palate and tongue areas. Use a gloved finger, a water-based oral hydrating gel and apply and rub into the soft tissues. The gel would soften the secretions after a couple of minutes, remove it using a dampened gauze. Remove the secretions using circular motions.
16. The tongue can be cleaned from back to front with a tongue brush under light pressure.
17. Instruct them to replace your toothbrush every three months or sooner if bristles are splayed or worn.

There are minor variations in oral care with increasing severities of dysphagia. The table that follows depicts the same

Table 4.1:

Oral care across increasing severities of dysphagia

Severity	**Management of oral care**
Minimal dysphagia	Generally used hygiene measures: Brushing twice in a day using fluoridated toothpaste, gargling or clearing mouth with water after a meal.
Mild dysphagia	Brushing using a low foaming and high fluoride content tooth paste. Flossing recommended that could remove debris between the teeth. Interdental brushes also to be used.
Moderate dysphagia	Brushing after every meal is mandatory.
Severe dysphagia	Brushing using a dry or a damp brush without any paste usually as a measure to prevent aspiration. Topical application of fluoride product done using oral swab to clean the oral cavity. The same to be done for 2 times in a day.

APPENDIX – C

Worksheet 1: This can be used for exercises that are measured in terms of duration. The longest duration that was performed by the patient on that day of the session is recorded under the day 1 column and likewise the responses across the week can be documented. The name of the exercise carried out is written in the first column.

Worksheet 2: This chart is used for exercises that are performed based on number of repetitions. The highest number of repetitions by the patient on that day of the session is marked on the day 1 column and likewise the responses across the week can be documented. The name of the exercise carried out is written in the first column.

d

WORKSHEET 1- FOR DURATION BASED EXERCISES

Exercise / Trial	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7	**COMMENTS**

WORKSHEET 1- FOR DURATION BASED EXERCISES

Exercise / Trials	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7	COMMENTS