Electromyographic activity of masseter muscle during swallowing in total laryngectomized subjects: review of literature

Atividade eletromiográfica do músculo masseter durante a deglutição em laringectomizados totais: revisão de literatura

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ABSTRACT

Laryngeal neoplasm ranks in the second place among the neoplasms that affect the head and neck region. In advanced neoplasm cases, total laryngectomy may be indicated to the patient, which has consequences like changes in swallowing. These changes cause interference in the swallowing biomechanics, modifying the action of muscle groups involved in this function and the masseter muscle helps to stabilize the mandible. Surface electromyography evaluates the electrical activity of a muscle group during its activity and can be an alternative to evaluate the behavior of masseter muscle during swallowing in total laryngectomized subjects. The purpose of this article was to review the literature about this theme. The search was conducted in scientific databases using the uniterms: electromyography, masseter, swallowing, laryngeal neoplasm. They were also used as keywords. Articles in English, Spanish and Portuguese were considered. Any articles relating directly to the electrical activity of masseter muscle during swallowing in total laryngectomy were found, showing a scarcity in literature. However, was possible to establish relations between the concepts and there is a need for more studies in this area.

KEYWORDS: electromyography, masseter muscle, swallowing, laryngeal neoplasms.

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RESUMO

O câncer de laringe ocupa o segundo lugar dentre as neoplasias que atingem a região de cabeça e pescoço. Em casos avançados, existe a indicação de laringectomia total, que traz dentre suas sequelas, alterações na deglutição. Essas alterações interferem na biomecânica da deglutição, alterando a ação dos grupos musculares que participam dessa função. O músculo masseter auxilia na estabilização mandibular no momento da deglutição. A eletromiografia de superfície avalia a atividade elétrica de um grupo muscular durante sua atividade e pode ser uma alternativa para avaliar o comportamento do músculo masseter durante a deglutição em laringectomizados totais. O objetivo desse artigo foi realizar uma revisão da literatura acerca desse tema. A busca foi realizada em bases de dados científicas, utilizando os unitermos eletromiografia, músculo masseter, deglutição, câncer de laringe. Os mesmos também foram utilizados como palavras-chave. Foram considerados artigos em inglês, espanhol e português. Não foi encontrado nenhum artigo relacionando diretamente a atividade elétrica muscular do masseter durante a deglutição em laringectomizados totais, o que mostra uma lacuna a ser preenchida na literatura científica. No entanto, foi possível estabelecer relações entre os conceitos e constatar a necessidade de mais estudos nessa área.

PALAVRAS-CHAVE: eletromiografia, músculo masseter, deglutição, neoplasias laríngeas.

INTRODUCTION

The larynx is the location of 25% of malignant tumors that affect the head and neck region, representing the second most common site to be hit by neoplasm in this region[1]. Treatment may include many types of surgery, radiotherapy, chemotherapy or combined treatments. The indication for each case depends on factors such as lesion size, location, nature and staging[2]. Among complications imposed by the treatment, there are disorders of swallowing, wich are called oropharyngeal dysphagia[3].

Swallowing requires activity of some muscle groups like the suprahyoid and masseter muscles. This last one has the function to stabilize the mandible during swallowing, preventing mandibular depression by suprahyoid action[4]. In total laryngectomy, the absence of hyolaryngeal complex and the effects of neoplasm treatment alter the normal physiology affecting the mentioned muscles activity.

Surface electromyography is the method of recording the muscle electrical activity[5] and can have important subsidies for understanding the altered biomechanics of swallowing in total laryngectomy in individuals.

The aim of this paper is to review the literature on the electromyographic activity of masseter muscle during swallowing in total laryngectomized subjects.

METHOD

This is a study of literature review. The survey was conducted in SCIELO, MEDLINE / PUBMED, MEDLINE and LILACS databases, linked to the BIREME Virtual Health Library (http://bireme.br) and CAPES database. Were used the keywords taken from the Descriptors in Health Sciences (DeCS): electromyography, masseter muscle, swallowing and laryngeal neoplasms. The search was also performed using the same keywords in Portuguese and English. Were considered original and literature review articles published from 1970 to December 2009, in English, Spanish and Portuguese.

In addition to the articles selected in accordance with the above criteria, was consulted the references of these articles and if these references were interesting, they were included.

The review was structured in the following topics: masseter muscle, swallowing, surface electromyography and laryngeal neoplasm.

LITERATURE REVIEW

Masseter Muscle

The masseter is considered the most powerful muscle of swallowing[6,7] and most evident due to its superficial situation[8]. It is a large, thick and rectangular muscle located on either side of the face, prior to the parotid gland. It has a superficial and deep parts[6]. Its superficial part originates in the anterior third of the lower margin of the zygomatic arch, takes an oblique, lower and back path inserting into the side of the mandible branch. The deep part originates on the posterior third and inner side of the zygomatic arch to the branch, turning vertical and inferior, above the mandibular angle[6].

Both parties are responsible for mandibular elevation. However, the superficial part propels the mandible, while the deep part is responsible for retrusion[4,9].

It consists of skeletal muscle tissue to be associated with bones and have their voluntary activities controlled by neurons. Muscle tissue has four specific properties that allow to functionate and contribute to homeostasis: electrical excitability, which is common to muscle fibers and neurons and the ability to respond to certain stimuli by producing electrical signals (action potentials) that propagate along the cell membrane due to the presence of specific ion channels; contractility, which is the ability of muscle tissue to contract when stimulated by an action potential; extensibility, which is the ability of muscle to be stretched, without being injured; and elasticity, which is the ability of muscle tissue to return to its original length after contraction or extension[10].

Swallowing

Swallowing is an action by a series of mechanisms and phases depending on the neuromuscular system, which transports the food to the digestive system and cleans the respiratory system of residues[11].

Since the 80s, the physiology of swallowing is described in four phases: oral preparatory, oral pharyngeal and esophageal[12]. Recently, the literature indicates the existence of the anticipatory stage[13]. This stage can also be called a cognitive phase of swallowing that occurs before the act of swallowing and it is related to the choices learned through life about eating, directing to decisions about what, how and when feed.

The oral preparatory phase begins with the placement of the bolus in the oral cavity and the action of the sealing lip. The oral phase occurs when the tongue eject that volume against the hard palate, directing the bolus after the arches of pharyngeal jaws. Thereafter, there is the triggering of the swallowing reflex, initiating the pharyngeal phase. All the following events are considered involuntary, unlike the previous phases. The volume is transported through the pharynx by peristaltic contractions of the cricopharyngeal muscle reaching the pharyngoesophageal transition, when occurs the upper esophageal sphincter relaxation and continuation of the volume path to the stomach[5].

The oral component of swallowing is mainly composed by movements associated with mastication. Mastication decreases the size of the food by breaking (incision, crushing and grinding) by the teeth[14] and emulsion with saliva, where the food is processing which oral sensations are generated[15] for further performance of swallowing and the food bolus that could pass through the gastrointestinal tract. During the mechanism of the chewing, the mandible can perform many movements (lifting, lowering, protrusion, retrusion, lateral jaw projection), coordinated by the contraction of the masticatory muscles, consisting of four pairs who emerge from the brain bones and insert in the mandible.

The masseter is one of the three pairs of muscle that are involved in mandibular elevation beyond the anterior temporal and medial pterygoid. The other pair, the lateral pterygoid muscle, is

responsible for lowering of the mandible and with the medial pterygoid and masseter participates of the protrusion movement. The temporal posterior is responsible for the movements of the lateralization of the mandible[16].

In addition to the masticatory muscles, other muscle groups also contribute to the mechanism of swallowing, among them the suprahyoid muscles (mylohyoid, anterior and posterior bellies of the digastric, geniohyoid and stylohyoid) and infrahyoid (thyrohyoid, sternohyoid, sternothyroid and omohyoid). The main actions of these muscles consist of mandibular depression and fixation of the hyoid bone during mastication, tongue movement at the beginning of the pharyngeal phase and antero-superior traction of the hyoid bone during swallowing[11].

The suprahyoid muscles help hold the hyoid bone fixed at the oral phase because of its connection with the bone and the mandible. In the pharyngeal phase, these muscles help in the fixed mandibular and the hyolaryngeal elevation and anterior movement during swallowing[16]. Among the infrahyoid muscles, the thyrohyoid has more effective participation during swallowing. This muscle helps the laryngeal elevation in relation to the hyoid bone in the hyolaryngeal complex movement during the pharyngeal phase and still participates of the upper esophageal sphincter opening in the next phase[16].

The muscle behavior during the mechanism of the chewing, particularly in its oral and pharyngeal phases, presents a highly complex by the large overlap of muscles activated and functions involved because during swallowing, masticatory muscles, pharyngeal and laryngeal act synergistically to realize this function[17] .

Electromyography

According to the literature, a way to get data for an initial evaluation and monitoring of swallowing changes is the electromyographic study. Electromyography (EMG) is the method for recording the electrical activity changes of muscles during its contraction[18-20]. Evaluates mainly the physiological and pathological conditions of muscle, provides information about the principles of muscle function[18] and can contribute with important information for the diagnosis[21].

Surface electromyography has been considered the most accurate and objective instrument to evaluate the electrical activity of orofacial muscles due to the facility for other metrics. It is characterized by a noninvasive, free of discomfort and radiation, fast, inexpensive and easily understood by the patient[5,22]. It has been widely used for muscle and functional rehabilitation as a quantifying instrument of muscle activity[23], helping in the diagnosis and treatment of orofacial motor disorders, such as mastication and swallowing[20], examinating the action of a muscle group or a specific muscle bundle[19].

The electromyographic record requires a system with a signal source, the electrodes that capture the electrical potential (activity) in muscle contraction (input information phase), an amplifier, which processes the small electrical signal (processing phase); a decoder, which provides a graphic display and/or hearing the sounds allowing the complete data analysis (output information phase)[24,25].

The origin of the electromyographic signal is based on the electrical potential generated by muscle examined from the activity of motor units that compose it. The motor unit consists of an anterior horn cell, an axon, its neuromuscular junction and all muscle fibers innervated by the axon. Each muscle fiber of motor unit suffers simultaneous depolarization from the axonal impulse conduction. Depolarization produces electrical activity, which manifests as motor unit action potential (MUAP). From there, it generates the EMG interference pattern, plotted by the electromyogram and indicates the result of the MUAPs sum captured in the region where the electrodes are placed. The electrodes have the function of converting the bioelectric current of muscle or nervous tissue into the current formed by electrons[26].

Like any other method, the applicability of electromyography has some limitations. The electromyographic signals can be affected by anatomical and physiological properties of muscles, for control of the peripheral nervous system, the instrumentation used to collect the signs[27], the presence of malocclusions, occlusal interferences, muscle training, facial type and food [28]. Thickness and fat layer on the skin, electrode placement and motivation of the patient in the exam can also influence the results[29]. Furthermore, the interindividual differences make it difficult to determine significant quantitative differences between individuals in this type of exam[30]. Another possible limitation it is relates to a possible contamination of electrical activity record coming from other muscles or adjacent muscle groups, called *crosstalk*[26].

About the masticatory muscles, to reduce biological noise, to see the variation of dental contact and to have a dental evaluation to compare different individuals or the same individual at different times, the EMG potentials should be standardized to allow a use of transverse and longitudinal clinical[30]. Thus, to compare individuals by electromyographic data in absolute values is not considered because of the individual differences[32].

Signal normalization is essential in electromyography studies. Normalization techniques for the cycle or period of contraction and in relation to the amplitude value permit to convert absolute values and percentages of a reference value. Therefore, normalization is an attempt to reduce the differences between the different records of the same or different individuals to make the interpretation of the data reproducible[26]. Some options of signal normalization include the electromyographic signal peak during maximal voluntary contraction, the average or the electromyographic signal peak[26].

In the speech clinic, electromyography is considered an important contribution of the electrical activity patterns of facial and masticatory muscles, contributing to a more objective diagnosis and more effective intervention[33]. Subjective evaluations of muscle groups, such as palpation or visual inspection, the EMG can supplement the data of diagnosis, treatment and prognostic of cases in the speech clinic[34].

The variability of the application of surface electromyography related to disorders that can affect the stomatognathic system can be endorsed by a number of studies in this area, involving, for example, oral breathers[33], with facial paralysis[35], temporomandibular dysfunction[27], vestibular disorders[36], among others.

Despite the use of surface electromyography in the masticatory muscles, many doubts still exist about the specific behavior of the masseter muscle during rest and mandible movements[27]. Using surface electromyography, previous studies have noted the involvement of masseter activity during swallowing.

Through electromyographic study, has been established that during swallowing the masseter and anterior temporal muscles are activated at the same time that the sternocleidomastoid and suprahyoid muscles[37]. The same authors say that the myoelectric potential increases as the muscles gain strength to get in isometric contraction and stabilize the mandible during swallowing.

Another author also demonstrated that at the time of swallowing there is an increase in electrical activity of masseter muscle to stabilize the mandible followed by a decline of this activity after swallowing. The suprahyoid muscles is involved in both elevation of hyolaryngeal complex and the lowering of the mandible and it is neecessary the simultaneous contraction of the masseter muscle to stabilize the mandible and prevent its lowering by the action of the suprahyoid[17].

Evaluating 7 individuals during saliva swallowing in one experimental condition of the mandible fixation and comparing with swallowing without this fixation, was verified that in the experimental condition, the onset of electrical activity of masseter delayed compared to the natural condition and there is a tendency to a short l ength of electrical activity in the fixation condition.

The action of the masseter in swallowing was offset by mandible fixation, causing reduction and delay in starting the muscle activity during swallowing when it tries to stabilize the mandible against the depressor force of the suprahyoid muscles[38].

The corporal posture in the electrical activity of masseter during swallowing was also studied. In the supine position, the gravitational force works perpendicular in the direction to the masseter fibers while the action at 90° is in the direction of these fibers, contributing to the mandible depression. Masseter has less influence of gravitational effects when compared, for example, to the anterior temporal because the masseter consists of two cross sectioned fascicles in its anatomy. Even so, it presents the increase of the electrical activity of masseter during swallowing to as the angle decreases[39].

Some studies identified the electrical activity of muscles which involved in swallowing in specific population groups. In individuals using dental prostheses and suspected diurnal bruxism, there were no statistically significant changes in electrical activity of the anterior temporal in the swallowing task of water when compared to the control group[40].

A study of 111 normal individuals of both sexes with a mean age of 33.7 years investigated the electrical activity of the mandibular elevator muscles (masseter and temporal), submandibular muscles and neck muscles (sternocleidomastoid) during spontaneous swallowing of saliva with and without occlusal contact. So, it was found that the group that swallows with occlusal contact has a higher electrical activity of masseter and temporal and longer duration of swallowing[37].

Another study indicates that the muscular behavior may be influenced by the characteristics of the mandibular position in swallowing. It was verified that in this function, the masseter muscle activity and the duration of activity increases significantly in the presence of an occlusal interference, indicating the need for adaptation of muscle in an attempt to stabilize the mandible. This change would be greater than the act of mastication which can be explained by the fact that swallowing is an innate function, different from the other, which is learned and therefore more easily reprogrammable. Nevertheless, the mandibular position during swallowing is uncertain but it seems like distinct from central occlusion that occurs in mastication[41].

To study the influence of mandibular position in the electrical activity of masseter muscle during swallowing, 8 individuals performed swallowing of saliva in four different mandibular positions: maximal intercuspal position, left lateralized, right lateralized and protrusion, which were compared with the signal received in dental clenching at maximum (100%). There was no significant difference between the positions, however, the higher electromyographic activity was observed in maximal intercuspal position. In this position, the mandibular stability is favored by many antagonists parts in contact with each other, determining less pressure in the periodontal ligament and, consequently, a lower stimulation of periodontal mechanoreceptors which means less inhibition of activity of mandibular elevator and increased of EMG activity[42].

This situation seems to be more evidence in individuals with class III who can demonstrate an important occlusal change, especially related to the teeth before. Among the individuals with class I and II does not have significant difference in this respect[43,44].

As mentioned before, the two cross sectioned fascicles of masseter are fundamental in the physiology of muscle, as each fascicle has different insertion, resulting in different action to promote the mandibular stability during swallowing in different mandibular positions[42].

In the elderly population, the electromyography has characteristics inherent the natural aging process and predisposition to certain diseases. In this group, can find an increased of the time of muscle activity and a poor coordination between the muscles involved in swallowing[5]. Moreover, another factor that can interfere in the muscle activity in elderly is the edentulous. The absence of teeth

contributes to the increase of EMG potentials of elevator and depressor muscle of the mandible[45], as well as the presence of dental prostheses that may also generate changes in the electromyographic patterns of muscle groups[46,47].

In addition to compensation strategies, it is important to say that the individual variations in relation to craniofacial configuration and type of occlusion influence the electrical activity of the masseter muscle, which explains the significant changes in intra-individual when evaluates the masseter electromyography during swallowing and confirms that this task is a complex motor activity that recruits refined mechanisms of central control[42,48,49].

Laryngeal Neoplasms

The larynx is the second most common site affected by neoplasm in the head and neck region, accounting for approximately 25% of malignant tumors that affect this area and 2% of all malignant diseases[1]. The worldwide incidence of laryngeal neoplasm is approximately 136,000 new cases and about 73,500 deaths per year. Represents the second type of respiratory neoplasm more common in the world, behind the lung neoplasm[50,51]. The more common type of laryngeal neoplasm is the squamous cell carcinoma and the most affected region is the glottis[52].

This type of neoplasm represents 2.8% of new cases to men in the world, representing the tenth most common malignancy in this sex[53], who are in fifth and sixth decades of life[54]. However, in recent years there is an increased incidence in women with its greater exposure to risk factors such as tobacco and alcohol[54].

Smoking is the major risk factor for the development of laryngeal neoplasm. The risk increases when alcohol abuse is added to the smoke. Patients with laryngeal neoplasm, who continue to smoke and drink, have a decreased cure, increasing the risk of developing a second primary tumor in the head and neck region[1].

Other risk factors for laryngeal neoplasm include exposure to occupational and environmental factors such as tar, hydrocarbons, polycyclic aromatic hydrocarbons, perc, asbesto, nickel, chromium, mustard gas, wood and pesticides products. Prolonged exposure to radiation, gastroesophageal reflux, viral infection by human papillomavirus and genetic susceptibility to cancer are also indicated as risk factors for laryngeal neoplasm[54].

Laryngeal neoplasms generate controversy because of the diversity of therapies which may vary depending on the service that is performing the treatment[55]. Among the therapeutic options, there are various types of surgery, radiotherapy, chemotherapy or combined treatments. The indication for each case depends on factors such as lesion size, location, nature and staging. In smaller lesions, the procedures are more localized and more conservative including partial laryngectomy, radiotherapy and chemotherapy. In extensive and infiltrating lesions, radical surgery, with or without radiotherapy and chemotherapy may be applied[2].

In Brazil, the gold standard treatment for laryngeal neoplasm is still the preferred: primary tumors have the radiotherapy or endoscopic surgery with or without laser. In cases of advanced tumors, the traditional radical procedure (total laryngectomy associated with radiotherapy) is the most suitable because the profile of patients with head and neck neoplasm and the difficulties to introduce other options such as the radiotherapy protocols, chemotherapy and phonatory prosthesis in the country[55].

Total laryngectomy is the complete surgical removal of the larynx with closure of the hypopharyngeal mucosa, dissociation of communication between the airway and digestive system and the tracheostoma construction with the implementation of the trachea directly on the skin[56].

Total laryngectomy leads to significant changes in the patient, changing the body image and vital functions such as speech, breathing, swallowing and neck mobility and may result in

pain, postural changes and difficulty in performing daily activities[57], and can remove this individual from society[58]. Due to the mutilation, the individual lives under the continuous presence of tracheostomy and impact in the loss of the ability to communicate by laryngeal voice[59] which sometime the changes related to swallowing are minimized by the patient and by the healthcare team, neglecting during the consultation [60].

In all individuals submitted to total laryngectomy, the act of swallowing can be altered and its severity is linked to the resection for extension, structures involved during surgery, in other words, if there was a resection of one or more structures in whole or in part, the method of reconstruction of neopharynx and residual mobility of structures[3,60,56]. Therefore, it is possible to say that disorders of swallowing secondary to total laryngectomy have a multifactorial etiology, including some factors that surgeon has no control[60].

Swallowing complications in total laryngectomized may also associated with tumor recurrence, presence of a second primary tumors in the esophagus, stiffness of pharyngeal muscle by radiation, pseudoepiglottis formation, food regurgitation and incoordination of pharyngeal muscle[58,61,62].

It also decreased peristalsis and pharyngeal sensitivity, food waste in neopharynx after swallowing, pseudodiverticular formation of a ruptured of anastomotic stenosis of the pharyngoesophageal segment, effects of adjuvant or adjuncts treatments (radiotherapy and chemotherapy) and comorbidities such as age[60].

The type of neopharynx reconstruction is described as one of the most important influences of total laryngectomy about swallowing in total laryngectomized. Some of the features to pharyngeal closure during laryngectomy include: the closure direction (vertical or transverse, including the "T" or "Y" closures), the closure level (just mucosal closure, or mucosa and muscle), suture techniques (continuous or interrupted) and necessity or not of myotomy. The choice of reconstruction method of the pharyngeal defect depends on size and location of tumor and the surgeon's experience[60].

There is no study in the literature that correlates the type of reconstruction in total laryngectomy with the swallowing disorder. In Australia, researchers investigate through questionnaires sent to surgeons of the country how they performed the reconstruction of pharyngeal defects in total laryngectomized. Large heterogeneity was observed because there is no standardization for this procedure[63].

Important elements that affect the swallowing were mentioned by some surgeons such as the maintenance of hyoid bone, when possible, to provide more stability to the tongue and floor of the mouth, and the rehabilitation of the suprahyoid muscles mentioned by only one-third of respondents. Nevertheless, there is no clinical and scientific evidence about what type of pharyngeal reconstruction that provides better results to swallowing[63].

After total laryngectomy, the major helping component to propulsion of the food bolus consist the combination between the tongue base movement to the pharyngeal wall associated with gravity. If the suprahyoid muscles have been reinstated, its contraction will help in dilatation of cricopharyngeal and thyropharyngeal muscles when the bolus gets into the esophagus. Some surgeons suggest that the suprahyoid muscles reinsertion is made superior to the closure defect but there is no evidence of the technique with the swallowing effects[64]. The physiology of swallowing adapted after total laryngectomy is still not well documented and depends on the surgical technique[65].

In a study performed with 55 total laryngectomized, the researchers evaluated the swallowing complications during the first month after surgery and after the first month. They identified 19 complications in the first month in 27% of these patients. After the first month, the number of complications increased to 43, affecting 36% of the sample[66].

Another study analyzed the difficulties to swallow with 120 total laryngectomized in Australia and verified that 71,8% of them reported changes in their diet or eating habits after total laryngectomy, affecting their socialization and isolating of activities like dinner with friends and go to restaurants[65].

In Brazil, a study conducted at the Federal University of São Paulo also investigated changes in eating habits of patients undergoing surgery for laryngeal neoplasm from an interview with 36 patients. Of these, 25 were laryngectomized and 11 undergoing frontolateral vertical partial laryngectomy. The results showed that among the total laryngectomized, 48% said that they had some difficulty in swallowing, 56% reported changes in food consistency after surgery, 60% reported weight loss and 69% had difficulty to swallow after radiotherapy. Besides these, other complications and compensations were said by total laryngectomized such as reflux, cough, asphyxia, feeling of blood stasis, noise when swallowing, regurgitation, pharyngeal globus, respiratory distress, head maneuvers, reduced food intake and multiple swallowing[59].

The application of quality of life protocol in swallowing (*Quality of life in swallowing disorders - SWAL-QOL*) in total laryngectomized patients showed areas with moderate impact, including communication, desire for food, social function and food selection[67]. In this study, it is interesting to note that individuals who had the worst scores were restricted to solids despite all feeding orally. This indicates that the restriction to food consistency can affect the quality of life of total laryngectomized.

In a group of 28 patients undergoing total laryngectomy and pharyngolaryngectomy, only 21,4% reported some swallowing complaints. Evaluated with videofluoroscopy, 64,3% of patients were diagnosed with dysphagia with changes in the oral preparatory and pharyngeal phases. Were identified inadequate training of food bolus and increase in oral transit time. The authors relate the findings not only to surgery but to radiation effects and absence of teeth. In the pharyngeal phase, the main finding was blood stasis possibly caused by muscle rehabilitation of neopharynx[68].

Due to the decoupling of the digestive and respiratory systems in total laryngectomized patients, swallowing can occur at any stage of the respiratory cycle and do not have aspiration risk[69].

In literature, the physiology of the adapted swallowing after total laryngectomy is still not well documented and depends on the surgical technique[66].

As previously, the masseter muscle interacts with the suprahyoid and infrahyoid during swallowing stabilizing the mandible. In total laryngectomized, there is an altered swallowing biomechanics due to the absence of hyolaryngeal complex, manipulation of the suprahyoid and infrahyoid muscles and type of reconstruction of pharyngeal defect. Therefore, it is possible to say that this muscle group modifies inherent to the surgery and the masseter may also show variations in its action because of its physiological linkage in this case.

In not laryngectomized individuals, the masseter stabilizes the mandible during swallowing acting as an antagonist of depressor mandibular muscle at the time of the hyolaryngeal elevation and anterior. In total laryngectomized, this action does not exist and the bolus is ejected directly from the oral cavity for neopharynx without establishes relations with the airway. In these individuals, it can be possible that masseter carries out an distinct activity increasing or not its stabilizing action. However, the literature does not respond to this supposition. The actual reconstruction technique lacks of evidence about its influence on the patient swallowing.

Surface electromyography can be an interesting alternative to investigate the electrical activity of the masseter muscle during swallowing in total laryngectomized. This procedure can provide data on this muscle group recruitment in swallowing and may help to confirm or not the hypothesis above.

In literature, no articles were found that published the surface electromyography of the masseter on swallowing function in total laryngectomy. Moreover, this muscle group was not mentioned in the articles which talk about with laryngeal neoplasm. However, the masseter in swallowing of these individuals can help in better understanding of the physiological rehabilitation that treatment requires.

This gap should be filled through studies that valorize the masseter action in swallowing which can be achieved through the use of surface electromyography.

ACKNOWLEDGMENT

The authors thank the National Council of Technological and Scientific Development (CNPq), which had a financial support with Universal Edictal MCT/CNPq 14/2009 – Range B - Process: 476412/2009-9.

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