

THE USE OF ELECTRICAL STIMULATION IN SPEECH THERAPY CLINICAL: AN INTEGRATIVE LITERATURE REVIEW

Uso da eletroestimulação na clínica fonoaudiológica: uma revisão integrativa da literatura

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ABSTRACT

The purpose of this study is to present the integrative literature review: about the applying result of the electrical stimulation use in the speech therapy clinic. The methodology used followed the concepts of the Cochrane Handbook involved question formulation related to the topic of investigation, identification and selection of the studies, and a critical evaluation of the selected articles. Selection of articles data bases of Medical Literature Analysis and Retrieval System *on-line* (Medline), Latin American Literature and the Caribe in Health Science, PubMed and Web of Science/ISI were used. The descriptors used were “transcutaneous nervous electrical stimulation”, “dysphagia”, “swallowing disorder”, “dysphonia”, “voice disorder” AND “speech language” in English, Portuguese and Spanish and its combinations, from 2003 to 2013. The electrical stimulation brings benefits the rehabilitation in speech therapy, but the methodology used in the studies was divergent and the studied population was very heterogeneous and it makes difficult its clinical use by the professionals of the area. The electrical stimulation brings benefits the rehabilitation in speech therapy clinic. But the new studies should be carried out using a more homogeneous sample and describing the methodology and the speech therapy techniques used into procedures, in order to prove its results and make its use feasible to the professionals of the area.

KEYWORDS: Transcutaneous Electrical Nerve Stimulation; Dysphagia; Swallowing Disorders; Dysphonia; Voice Disorders; Speech, Language and Hearing Sciences

■ INTRODUCTION

The transcutaneous electrical nerve stimulation (TENS) is a simple method in the field of electrotherapy, it is a therapeutic technique used in physical therapy for over half a century¹. This is a noninvasive clinical tool used in many cases to combat pain, promoting muscle relaxation, improvement in vascularization at the site of application and significant effect on the reduction of fatigue and muscle overactivity². Moreover, neuromuscular electrical stimulation (NMES) is presented with major importance in several segments in clinical rehabilitation can be used to effectively increase muscle strength, to reduce the weakness in neuromuscular performance by minimizing failure associated with

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spasticity, where muscle paralysis such as facial paralysis, etc.^{3,4}.

The Physiotherapy finds in the electrostimulation a powerful resource to assist the process of rehabilitation of several disturbances⁵. Over the years a growing body of research on the benefits of electrostimulation is emerging in different fields of expertise, increasing the range of the resource application possibilities.

The speech therapy can benefit and present satisfactory results with this technique combined with conventional therapy. Studies have shown favorable results of the use of electrical stimulation in improving voice quality and swallowing patients in speech therapy^{6,7}.

Dysphonia can be defined as any difficulty or change in natural emission of the voice. The literature points to muscle tension dysphonia as a hyperfunctional change in phonation, caused by benign laryngeal lesions such as nodules and mucous thickness⁸. Techniques of cervical and laryngeal relaxation are recommended in the treatment of muscle tension dysphonia in order to seek the balance of intrinsic muscles of the larynx⁹, so TENS can collaborate in the treatment of dysphonia hyperfunctional promote analgesia and muscle relaxation.

Dysphagia is a change in swallowing, or the act of swallowing food or saliva. It can occur at different stages of life, especially in the elderly, may have serious health consequences. The consequences of dysphagia substantially reduce quality of life, increase the risk of medical complications and mortality, and represent a significant cost to health systems. As a result, clinical and scientific communities have shown interest in new ways of dysphagia rehabilitation. NMES in the treatment of swallowing disorders is one of the interventions currently studied in the literature, but many questions about its effectiveness remain unanswered¹⁰.

Considered one of the current therapeutic resources for oropharyngeal dysphagia, NMES is used since 1997 in the United States when it was approved by *Food and Drug Administration* (FDA), in order to promote suprahyoid drive, laryngeal and favoring the contraction of the muscle groups directly involved with swallowing¹⁰. Between 1997 and 2000 extensive research on the use of electrical stimulation in the treatment of dysphagia was performed, aiming at enabling by the FDA¹⁰ for the release of a stimulator device, the VitalStim®, of specific use for the treatment of dysphagia, proving

to be safe and efficient electrical stimulation to this treatment modality.

Unlike the use of electrical stimulation on dysphagia respect, the tables of dysphonia are still being tested with the use of electrical stimulation.

The aim of this study is to present an integrative literature review, looking for scientific evidence of the suitability and the result of the use of electrical stimulation on speech therapy clinical practice in the treatment of dysphonia and dysphagia.

■ METHODS

To establish the search criteria followed by the precepts of the *Cochrane Handbook* and Souza^{11,12}, involving the formulation of the question to be investigated, location, selection of studies and critical evaluation of the articles. The question of research that supported the review was: what is the effect of electrical stimulation in the treatment of dysphonia and dysphagia in the speech therapy clinic?

To select the articles were used databases Medical Literature Analysis and Retrieval System Online (Medline), Latin American and Caribbean Health Sciences (LILACS), PubMed and Web of Science / ISI. Thus, it sought to broaden the scope of research, minimizing possible bias in this stage of development of integrative review process.

The inclusion criteria of definite articles, initially for this integrative review were: articles published in Portuguese, English or Spanish, with abstracts available in selected databases and which fitted the research question in the period 2003-2013.

Because the specific features to access the selected databases, the strategies used to locate the articles were adapted to each, with the axis guiding the question and the inclusion criteria of the integrative review, previously established to maintain consistency in search articles and avoid possible biases. The descriptors used were: "transcutaneous electrical nerve stimulation", "electrical stimulation", "dysphagia," "swallowing disorders," "dysphonia", "voice disorders", "voice training" and "electrical stimulation therapy" in English, Portuguese and Spanish, and combinations thereof. All items found with the combination of descriptors and indexed in the selected databases were included. The search was conducted by online access and using the inclusion criteria, the final sample of this integrative review consisted of 28 articles, of which 22 were in MEDLINE / PubMed, four in LILACS, and 2 in *Web of Science/ISI*.

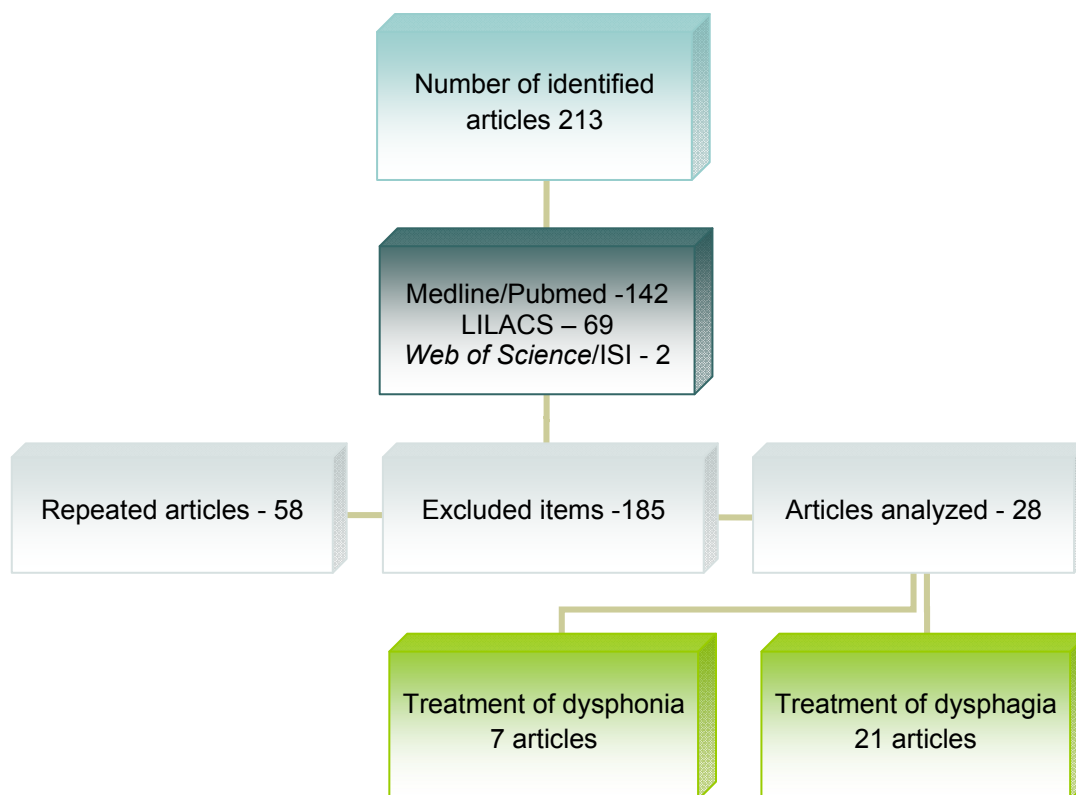


Figure 1 – Selection and analysis of the articles

The criteria for the inclusion of the research were defined based on the question that guides the review. Inclusion criteria were: papers discussing the effect of electrical stimulation in the treatment of dysphagia and dysphonia, published in the last ten years; and exclusion were: articles in languages other than English, Portuguese or Spanish, published in the period prior to 2003 and those who did not refer to the purpose of the investigation.

Initially were located 213 articles using the keywords and combinations thereof, but many were excluded because the objectives and the methodology proposed differed the inclusion criteria of this integrative review.

After the descriptive analysis, 28 studies that suited the inclusion criteria were used for the integrative review.

The information was organized in a concise way in a database with information about the sample, objectives, and methodology and key findings and organized by similarity of content.

For analysis of the 28 selected studies the following markers were considered: type of study (clinical trials and experimental research, case studies and literature review), classification of the level of scientific evidence by Oxford Scale¹³, job objective, number of treatment sessions, description of the exercises and the main results.

The United States led the number of publications regarding the subject discussed, followed by Brazil. The predominant language is English, although some studies were of different origins. Looking at the table, it was observed that there is a very small number of journal articles on the subject, since it is recent in speech therapy. For the year of publication of the articles, the years 2007 and 2008 led the number of publications, with five publications each year.

The analysis of publications allowed the identification of two main themes: effect of electrical stimulation in the treatment of dysphonia and effect of electrical stimulation in the treatment of dysphagia.

Table 1 – Country and year of publication of articles

Local	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Germany					1							1
Brazil				1	1		1	1				4
USA	2		4	4	2	1	1	3	1			18
France							1					1
KOREA						2						2
Sweden					1							1
Thailand						1						1
Total/ Year	2		4	5	5	4	3	4	1			28

EFFECT OF ELECTRICAL STIMULATION USE IN THE TREATMENT OF DYSPHONIA			
OBJECTIVES OF THE STUDY	OUTCOMES	AUTHORS	SCIENTIFIC EVIDENCELEVEL
Effect of electrical stimulation in 69 patients with vocal cord paresis	Decreased vibration irregularity of the vocal folds; Increase in the TMF.	Ptok et al., 2008 ¹⁴	2B
Effect of electrical stimulation in two patients with vocal fold paralysis	Decreased voice breaks and vocal breathiness.	Guzman et al., 2003 ¹⁵	4
Effect of electrical stimulation in seven patients with vocal fold arching by presbyphonia	Increase in the TMF; Increased tension and better glottal closure.	Lagorio et al., 2010 ¹⁶	4
Effect of the use of TENS in dysphonic 10 women with bilateral nodules	One study did not benefit dysphonic individuals.	Guirro et al., 2008 ¹⁷	2C
Effect of the use of TENS in dysphonic 10 women with bilateral nodules	TENS decreased muscle activity and pain, and improved voice quality.	Berni et al., 2007 ¹⁸	2C
Effect of using the TES in 10 women and 10 men without vocal disorders	DOMS and small changes in fundamental frequency and voice quality.	Fowler et al., 2009 ¹⁹	2C
Effect of the use of NMES in 12 subjects without voice alteration divided into experimental group and control	Instability, DOMS and vocal fatigue were reported with the use of NMES.	Fowler et al., 2011 ²⁰	2C

Legend: NMES: Neuromuscular electrical stimulation

TENS: transcutaneous electrical nerve stimulation

TES: transcutaneous electrical stimulation

Figure 2 – Effects of electrical stimulation of use in the treatment of dysphonia

EFFECT OF ELECTRICAL STIMULATION USE IN THE TREATMENT OF DYSPHAGIA			
OBJECTIVES OF THE STUDY	OUTCOMES	AUTHORS	SCIENTIFIC EVIDENCE LEVEL
Literature review on the use of NMES in the treatment of dysphagia.	The review showed that the use of NMES dysphagia associated with traditional therapy promoted advances in the diet, decreased penetration and aspiration in over 50% of patients treated with this approach.	Humbert et al., 2012 ⁷	3A
Thousand professionals answered a questionnaire about the results of NMES	NMES brings benefits to patients, with improvement in the diet of patients and decrease in penetration and aspiration.	Crary et al., 2007 ²¹	5
Case-control study that compared the effects of NMES in the treatment of dysphagia with conventional therapy	Both methods showed positive results with no difference between them.	Carnaby Mann & Crary 2010 ²²	3B
Study with 80 subjects compared the effects of NMES with conventional therapy	The therapy for dysphagia associated to NMES showed superior results.	Blumenfeld et al., 2006 ²³	2B
Study of 22 subjects compared the effects of NMES with conventional therapy	The therapy for dysphagia associated to NMES showed superior results.	Kiger et al., 2006 ²⁴	2B
Survey of 28 patients with dysphagia after stroke compared the effect of tactile-thermal therapy traditional NMES associated with conventional therapy	The tactile-thermal therapy associated to NMES showed better results when compared to traditional thermal-tactile therapy. Both groups showed improvement, but the group receiving the combination therapy to NMES was more significant results as improvement in pharyngeal transit, lower level of aspiration and penetration.	Lim et al., 2009 ²⁵	2B
Survey of 23 patients with dysphagia after stroke compared the NMES therapy effect associated with traditional therapy	Both groups had satisfactory results, however, associated to NMES therapy showed better results compared to traditional therapy with improvement of dysphagia.	Permsirivanich et al., 2009 ²⁶	2B
Search 25 post stroke dysphagia patients compared the NMES therapy effect associated with traditional therapy	After 15 sessions of treatment, NMEE the combination therapy showed similar results to conventional therapy.	Bulow et al., 2008 ²⁷	2B
A case report of a patient of 74 years old, with mechanical dysphagia.	Significant improvement of both dysphagia and dysphonia, with better tension of the vocal folds and greater glottal closure.	Lagorio et al., 2008 ²⁸	4
Study evaluated the benefits of NMES on swallowing and oral intake and rehabilitation of 18 dysphagic individuals by different etiologies	Eleven of the 18 patients (61%) showed improvement in swallowing, six (33%) improved enough to no longer need the feeding tube and five patients classified as "severe dysphagia" only 2 showed some improvement.	Shaw et al., 2007 ²⁹	2B
Study on the effect of NMES in the rehabilitation of patients diagnosed with chronic dysphagia	The study confirmed one of the objectives of the study was to determine the physiological effects of NMES on the position of the hyoid bone and larynx in the neck and it was confirmed that there was lowering of the hyoid, the second objective was to verify if there was greater risk of penetration / aspiration during swallowing using NMES and the result indicated that there was no increased risk.	Ludlow et al., 2007 ³⁰	2B
Meta-analysis study on the benefits of NMES on swallowing and oral intake and rehabilitation of dysphagic individuals by different etiologies	The best evidence showed that NMES is a therapeutic resource that brings benefits to individuals with dysphagia.	Carnaby Mann & Crary 2007 ³¹	3A
Survey of 06 subject's dysphagia examined the beneficial effects of NMES on the biomechanics of swallowing.	The study showed satisfactory results in improved functional ability of swallowing.	Carnaby Mann & Crary 2008 ³²	4
Study looked at the effects of NMES in the rehabilitation of 11 patients with dysphagia	The study found significant gains in swallowing and aspiration decreased after use of NMES.	Gallas et al., 2010 ³³	2B
Research examined the effect of NMES on swallowing 16 healthy individuals	There was an increase of the hyoid bone excursion during swallowing, but after two weeks the gain was not sustained.	Park et al., 2009 ³⁴	2B

Study of NMES effect on the elevation of the hyoid during swallowing and the effect application in ten sites in submental region and laryngeal healthy individuals	There was increased myoelectric activity of the larynx and the hyoid gain in elevation with swallowing effort.	Humbert et al., 2006 ³⁵	2B
Research evaluated the swallowing of 08 healthy people after the application of NMES	Seven of the eight subjects of the study did not show significant gains in the myoelectric activity of the larynx swallowing.	Suiter et al., 2006 ³⁶	2B
Study on the use of NMES in the treatment of dysphagia in 30 children	With the use of NMES children presented total or partial recovery of swallowing.	Christiaanse et al., 2003 ³⁷	2B
Search case-control with 93 children with dysphagia and the result of NMES	Treatment with NMES and conventional therapy showed satisfactory results.	Christiaanse et al., 2011 ³⁸	3B
Literature review on the applicability and effectiveness of the use of NMES in dysphagia	There are differences both in applicability as the results of this method. NMES benefits patients with improvement of oropharyngeal dysphagia, such as dietary return orally and decrease episodes of tracheal aspiration.	Cola et al., 2011 ³⁹	3 ^a
Kind of study literature review on the results of the use of NMES in the treatment of dysphagia	NMES is a non-invasive and easy to apply with positive results in the treatment of oropharyngeal dysphagia.	Guimarães et al., 2010 ⁴⁰	3 ^a

Figure 3 - Effect of use of electrostimulation for the treatment of dysphagia

■ LITERATURE REVIEW

From the applied methodology, we selected 28 references, 4 national posts and 24 international articles.

The data found in this literature review showed the emphasis that has been given on the use of electrical stimulation in the treatment of dysphonia and dysphagia in the United States, who led the number of articles, with 18 publications, followed by Brazil with four publications, with Korea two publications, and Germany, France, Sweden and Thailand, with a publication of each country about the topic.

Regarding the year of publication of the articles, it can be seen that two articles were published in 2003, four in 2006, five in 2007, five in 2008, four in 2009, three in 2010 four in 2011 and published in 2012.

Electrostimulation in the treatment of dysphonia

Effect of electrical stimulation in patients with neuromotor changes of vocal fold

A study with level of evidence 2B¹⁴ compared the results of traditional voice therapy with the combination therapy NMES. Sixty-nine patients with laryngeal nerve palsy were recruited to participate in a prospective, randomized, divided into experimental group (EG, n = 36) and control group (CG, n = 33). As a result there was a decrease of vibration of the vocal folds irregularity in significantly greater degree in the group (GE) and increase in the maximum phonation time (MPT) similar in both groups after a period of three months of therapy. The study describes the vocal therapy associated

with electrical stimulation is a non-surgical therapeutic procedure that has been shown effective and superior to conventional vocal therapy.

Benefits of electrostimulation associated with vocal therapy in patients suspected of vocal fold paralysis was the object of a retrospective case study with level of evidence 4¹⁵ reporting the clinical efficiency of NMES combined with traditional vocal therapy in two female patients with suspected vocal fold paralysis. NMES was used simultaneously with vocal exercises based on phonation tasks for 45 minutes and the results were analyzed after eight sessions. Decreased vocal voice breaks was identified in one case and in another there was improvement in vocal quality with fewer breathiness and both patients reported significant improvement in their vocal complaints. The study concludes that the vocal therapy associated NMES can be a useful tool for rehabilitation of patients with vocal fold paralysis. The findings of the retrospective case study¹⁵ are validated by the study, 36 subjects diagnosed with vocal fold paralysis, these results demonstrate the good of speech therapy results of electrical stimulation in this group of patients.

A survey investigated the result of vocal therapy associated to NMES in the rehabilitation of dysphonia by bilateral arching vocal folds by presbyphonia using a traditional therapy program combining vocalization techniques with NMES for the study with level of evidence 4¹⁶, seven individuals with chronic dysphonia were selected by convenience sample and underwent treatment with NMES associated with traditional therapy fourteen steps of vocalizations and the results showed increased TMF (maximum phonation time) and better glottal

closure, as well as increased the tension of the vocal folds after speech therapy. Research shows that electrical stimulation may be beneficial in rehabilitation neuromotor cases, but the literature still needs more evidence in the research.

Effect of the use of TENS in women with muscle tension dysphonia

Two surveys of levels of evidence 2C^{17,18} they evaluated the effect of TENS in dysphonic women. A survey¹⁷ evaluated the effect of TENS on the pattern of activation of masticatory muscles in 10 dysphonic women with nodules or bilateral mucus thickening, and phonation fissure, justified by the fact that women dysphonic present increased muscle tension in the neck and shoulder girdle. TENS was applied on the upper fibers of the trapezius and sternocleidomastoid bilaterally, seeking muscular balance and relaxation of these muscles. The study found that resource use has not benefited dysphonic individuals, not being effective in improving coactivation the depressor muscles of the jaw during the contraction of the jaw muscles lifts. Another study¹⁸ evaluated the electrical activity of the muscles involved in speech, the pain and the voice of 10 dysphonic women with nodules or bilateral mucus thickening, and phonation fissure after the application of TENS) for 30 minutes two or three times a week. According to the results of the TENS decreased muscle electrical activity and pain, being beneficial in improving voice quality. The study then concluded that TENS produces benefits when used as an aid in improving the clinical and functional signs of dysphonic women.

New research with higher levels of scientific evidence should be conducted to further investigate the relationship between the activity of the masticatory muscles and the sensorimotor interplay in dysphonic patients, as individuals participating in the study which evaluated the electrical activity of the muscles involved in speech¹⁸ have resulted in the use of electrical stimulation pain reduction and improvement in vocal quality, being a beneficial procedure that can be used as a therapeutic resource adjunct to conventional treatment of speech therapy, which can bring gain in vocal quality dysphonic women.

Effect of electrical stimulation in subjects without vocal disorders

Two studies with evidence levels 2C^{19,20} aimed to analyze the benefits and the effect of electrical stimulation on vocal quality, the acoustic parameters of the voice, the fatigue and the reported sensations 5 minutes and 24 hours after application of transcutaneous electrical stimulation (TES) and NMES in

healthy individuals without vocal disorders. In one of them¹⁹ TES was applied for one hour and 20 participants were selected (10 females and 10 males), 20 to 53 years old, no smoking and no history of vocal disorders. As a result, subjective reports of delayed onset muscle soreness, measurable changes in the fundamental frequency and perceptual evaluation of voice have been found, but were not statistically significant and in the other study²⁰ NMES was applied for 30 minutes, in which 12 subjects were divided into experimental and control groups (06 female and 06 male) divided equally in both groups and only the GE was submitted to the use of NMES for 30 minutes. Instability, DOMS and vocal fatigue were reported by some of the participants in the GE 24 hours after use of NMES and conclude that 30 minutes can be a very high dosage for those receiving electrostimulation for the first time. The findings presented in electrostimulation even in a situation normal laryngeal function suggest that benefits can be achieved by optimizing voice production. These data suggest further research with professional voice users.

In individuals with vocal disorders are beneficial results in the use of electrical stimulation, but these results do not yet have robust scientific evidence because the number of subjects is small, and the methodology is diverse. Future studies should be designed to analyze the actual result of electrical stimulation on vocal clinic.

According to the literature, there are few publications on the applicability of electrical stimulation in the treatment of dysphonia¹⁴⁻²⁰ and studies that were part of this review show applicability in different vocal and with different approaches and that there is little proven scientific evidence on their behalf. However, research on the application of this new feature in the speech therapy clinical practice is recent and some questions deserve to be answered because there is controversy in the literature that may be related to the heterogeneity of the samples studied, since the surveys were conducted with different etiological frames of dysphonia, and various ages, as well as the lack of standardization method, and does not define the follow-up of patients during and after treatment.

Electrical stimulation to treat dysphagia

Research on the use of NMES in the treatment of dysphagia

A literature review study with level of evidence 3A⁷ on the clinical implications of using NMES was carried out to identify the values and limitations of the literature published on the subject and assist therapists in decision-making in clinical practice. The authors concluded that NMES brings benefits to

patients, but studies with higher levels of evidence must be carried out, especially with a large sample and with a more homogeneous group of patients, to then check your results.

A study was conducted with level of evidence 5²¹ about knowledge and perception of the therapists on the use of electrostimulation and the practical knowledge for the treatment of dysphagia patients. Thousand questionnaires were sent to two health centers and professionals were chosen randomly by computer through a database. Of these, 840 therapists (70%) said they used the technique with the time of sessions lasting on average one hour, three to five days a week. Dysphagia after stroke frame (AVE) was the most common etiology treated with this approach. Of these, 90% used electrostimulation associated with other traditional techniques and most noted advances in changing the diet of the patients and a reduction in the penetration and extraction in over 50% of patients. Patients reported to the therapists an 80% satisfaction level on the use of electrical stimulation during therapy and the level of satisfaction among professionals was 78%.

Three studies have compared the effects of electrical stimulation in the treatment of dysphagia with conventional therapy. The results of one study with level of evidence 3B²², in which patients were divided into GE treated with traditional therapy associated with NMES and GC treated with traditional therapy, it demonstrated that both groups benefited from the two therapeutic approaches, but were not statistically significant differences found between the two methods. In contrast, two other studies with evidence levels 2B^{23,24} NMES identified that the combination therapy is superior to traditional therapy, bringing increased oral intake, decreasing the degree of dysphagia and tracheal aspiration reduction and return the oral route. Thus, according to the authors, associated with the traditional electrostimulation therapy is more beneficial to patients as compared to traditional therapy.

Three researches with evidence levels 2B²⁵⁻²⁷ with post stroke dysphagia patients compared the NMES therapy effect associated with traditional therapy in the treatment of oropharyngeal dysphagia with traditional therapy. Both therapies have brought gains in the biomechanics of swallowing, but the associated NMES therapy showed better results when compared to traditional therapy in two studies^{25,26}. In one study²⁷, the two groups subjected to treatment showed benefits to participants, but there was no statistically significant difference between the two. Studies with higher levels of evidence are needed to understand the differences of these studies.

The change analysis in vocal quality after dysphagia therapy associated to NMES was performed in a case report study with level of evidence 4²⁸ a 74-year-old patient with dysphagia after chemotherapy and radiotherapy for cancer in the head and neck region. Besides dysphagia, it complained of dysphonia, vocal fatigue and difficulty being understood on the phone. After 15 traditional therapy sessions dysphagia associated to NMES, proven to be a significant improvement of both dysphagia and dysphonia, there was improvement of the tension of the vocal folds with greater closure of the glottis, resulting in improved voice quality and maximum phonation time. The result of this study reports a positive impact of dysphagia intensive care combining NMES in the function of laryngeal muscles.

Demonstrate the beneficial effects of NMES on the biomechanics and the physiology of swallowing and oral intake and rehabilitation of dysphagic individuals by different etiologies was the object of five studies, with respective levels of evidence 2B, 2B, 3A, 4, 2B²⁹⁻³³ that used heterogeneous samples, involving subjects following stroke, Parkinson's disease, cranial trauma, cerebral atrophy, head and neck tumors, among others. All studies have demonstrated satisfactory results, and in one of them²⁹ 61% of patients had improvement in swallowing, 33% had no more use of the feed tube being 6% (severe dysphagia) improved but still required to continue feeding by the feed tube. In one study with level of evidence 3A³¹ meta-analyses was conducted on the effect of NMES in the rehabilitation of dysphagia and the best indicative evidence showed results in favor of NMES in the treatment of dysphagia.

When it studied the effect of electrical stimulation on dysphagia patients, regardless of the etiology of dysphagia, the results were satisfactory. These findings suggest the development of new studies, the greatest scientific evidence in the survey, with more homogeneous groups of dysphagia patients in its various causes, so you can analyze the results of this new therapeutic approach in the rehabilitation of patients.

Electrostimulation of the effect on swallowing biomechanics of healthy individuals

Three studies with evidence levels 2B³⁴⁻³⁶ They tested the effect of electrical stimulation applied to the submental and laryngeal muscles of healthy subjects to evaluate the effect of NMES on the elevation of the hyoid during swallowing, examine the effect in 10 sites of application of NMES applied to the submental area for two weeks and see if it would have increased myoelectric activity of the larynx. In one study³⁴, there was an increase of the

hyoid bone excursion during swallowing, however, two weeks after the end of treatment the gain was not sustained. In the study³⁵ which evaluated 10 local application of electrical stimulation, described three local application did not produce the hyoid descent during rest and, on the elevation of the hyoid bone, there was a gain in elevation of the hyoid with swallowing effort. Seven of the eight subjects evaluated in a survey³⁶ they showed no significant gains with the use of NMES on myoelectric activity of the larynx. Research indicates that further studies are needed involving healthy individuals, in order to know the effect of electrical stimulation in this population, and so determine their influence on the biomechanics of swallowing, which will assist in the use of this resource in the therapeutic process.

Use of electrical stimulation in children with dysphagia

The use of NMES was reported in two studies involving children with dysphagia by different etiologies. In one study with level of evidence 2B³⁷ they attended by 30 children who were already in conventional therapy, but without satisfactory results. The children received treatment with NMES by an unbroken hourly, daily, for approximately 22 days, and of these 17 showed benefit in partial recovery of swallowing, five reached complete recovery. In another study with level of evidence 3A³⁸, 93 children were divided into GE (n = 46), with only the use of NMES and GC (n = 47) with conventional treatment for dysphagia. The conclusion was that both groups had satisfactory results, with no difference between them.

The studies involving the pediatric population showed that NMES is a therapeutic resource that provides benefits in dysphagia rehabilitation in children. Further studies with higher levels of scientific evidence involving the pediatric population should be performed in order to determine the ideal time of application and the frequency of use of NMES in the rehabilitation of these patients.

Brazilian studies of literature review on the applicability and results of the use of NMES in the treatment of oropharyngeal dysphagia

Two Brazilian studies literature review with levels of evidence 3A^{39,40} They were conducted addressing the applicability and the analysis of the results of the use of NMES in the treatment of oropharyngeal dysphagia. The authors concluded that the efficacy of rehabilitation in oropharyngeal dysphagia with use of electrical stimulation varies from 70% to 80%. They stressed that this is a non-invasive and easy to apply and should therefore be explored along with professional speech therapy. Recent

studies demonstrated that the used heterogeneous samples, making the understanding of the result of this technique, since a homogeneous for this control sample is required in which the events and the degree of commitment by dysphagia are similar. Another issue addressed by the authors was that, in the studies analyzed, there is no detailed description of the therapeutic procedures used and the frequency of use of NMES. The authors found that NMES is an effective method for the rehabilitation of patients with dysphagia beneficial changes within the oropharyngeal dysphagia as diet return orally, reduced episodes of tracheal aspiration, hiolaríngea increase in movements, decrease in time pharyngeal transit, reduction of xerostomia in cases of radiotherapy and increased level of oral ingestion, among others. As for the methods applied by comparing NMES, traditional therapy and combination therapy, the results showed that the combination therapy (NMES with traditional therapy) demonstrates better results, but its recent introduction to speech therapy and related fields has required scientific research, reviews updated to better understand its effects in order to provide best practice based on scientific evidence. Upon review, it can be seen that there are differences in both the applicability as the results of this method when used in populations affected by dysphagia and dysphonia, still necessary to clarify to what types of clinical manifestations patients will benefit most.

The data found in this integrative review of the literature Realize NMES is a method which has benefits for the rehabilitation of patients with dysphagia improvement within the oropharyngeal dysphagia, for example, the diet return orally decrease of aspiration episodes laryngotracheal, etc.^{26,32-34}. The methods applied, comparing the NMES, conventional therapy and the combination therapy, the results showed that combination therapy (NMES with conventional therapy) showed better results than the conventional treatment of dysphagia^{23,25}.

It was also found that there is a huge lack of research evaluating the ideal time of application of NMES, what types of disorders it is most appropriate and what types of exercises should be associated in the voice rehabilitation process.

■ CONCLUSION

It can be seen that electrostimulation is a method that brings benefits in the rehabilitation of individuals with dysphagia and dysphonia in speech therapy. In the treatment of dysphonia there was a decrease in the size of laryngeal lesions, dysphonia degree of improvement, increased TMF and glottal closure

with decreased tension of the vocal folds, and decreased muscle electrical activity and pain, being beneficial in improving vocal quality. The results of the studies showed that conventional therapy of dysphagia associated with electrical stimulation is beneficial and more efficient than just electrotherapy or conventional therapy and aids in the rehabilitation of this population in clinical speech therapy process. An improvement within the oropharyngeal dysphagia as diet return orally, reduced episodes of tracheal aspiration, hiolaríngea increase in movements, decrease in pharyngeal transit time, reduced in the cases of xerostomia radiation and increased intake level oral. Publications on the use

of electrical stimulation on speech therapy practice are fairly restricted, which are more prevalent in dysphagia area.

A methodological design of the research, using a more homogeneous sample, with a more careful and detailed description of speech therapy techniques associated with electrostimulation are needed to assess the real results of this therapeutic procedure in speech therapy and offer subsidy to use this feature therapy in clinical practice. Surveys with higher levels of evidence must be carried out to prove the effects of electrical stimulation in the treatment of dysphagia and dysphonia in clinical practice.

RESUMO

Este trabalho tem como objetivo apresentar revisão integrativa de literatura sobre a aplicabilidade e o resultado do uso da eletroestimulação na prática clínica fonoaudiológica. Foram seguidos os preceitos do *Cochrane Handbook*, que envolveu a formulação da questão a ser investigada, localização e seleção dos estudos e avaliação crítica dos artigos. Foram utilizadas as bases de dados *Medical Literature Analysis and Retrieval System on-line* (Medline), *Literatura Latino-Americana e do Caribe em Ciências da Saúde* (LILACS), *PubMed* e *Web of Science/ISI*. Os descritores utilizados foram: “estimulação elétrica nervosa transcutânea”, “estimulação elétrica”, “disfagia”, “transtornos de deglutição”, “disfonia”, “distúrbios da voz”, “treinamento da voz” e “terapia por estimulação elétrica” em inglês, português e espanhol e suas combinações, no período entre 2003 e 2013. Os estudos analisados demonstraram que a eletroestimulação traz benefícios na reabilitação de pacientes na clínica fonoaudiológica, mas a metodologia utilizada nos estudos foi divergente e a população estudada muito heterogênea o que dificulta sua utilização clínica pelos profissionais da área. A eletroestimulação traz benefícios na reabilitação fonoaudiológica, porém novos estudos devem ser realizados utilizando uma amostra mais homogênea e descrevendo metodologia e técnicas fonoaudiológicas utilizadas nos procedimentos, a fim de comprovar seus resultados e viabilizar seu uso pelos profissionais da área.

DESCRITORES: Estimulação Elétrica Nervosa Transcutânea; Disfagia; Transtornos de Deglutição; Disfonia; Distúrbios da Voz; Fonoaudiologia

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