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# VitalStim: Using Electrical Stimulation Therapy to Improve Dysphagia Symptoms in Adults

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VITALSTIM: USING ELECTRICAL STIMULATION THERAPY TO IMPROVE  
DYSPHAGIA SYMPTOMS IN ADULTS

by

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A Research Paper  
Submitted in Partial Fulfillment of the Requirements for  
the Master of Science Degree

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## **Introduction to VitalStim**

Dysphagia is defined as difficulty swallowing and affects nearly 15 million adults in the United States. According to Blumenfeld, Hahn, Lepage, Leonard, & Belafsky (2006) dysphagia can be extremely morbid, and complications include aspiration pneumonia, malnutrition, dehydration, pulmonary fibrosis, and death. Managing dysphagia as soon as it is detected is essential in treating these symptoms. There have been very few innovations in the treatment of swallowing disorders in recent years. VitalStim Therapy is a unique dysphagia therapy using neuromuscular electrical stimulation (NMES) to stimulate the muscles that are active during the swallow. Traditionally there are many other techniques used to treat dysphagia. Some of these techniques include compensatory strategies, diet modifications, thermal-tactile stimulation, and oral motor exercises. VitalStim is the only therapy technique that stimulates the swallowing muscles using an external electrical stimulation. The use of electrical stimulation has been practiced in the field of physical therapy for many years but has just recently been introduced to the treatment of swallowing disorders. Within physical therapy electro-stimulation is used to stimulate large muscle groups in patients. The same concept is applied to the

muscles of the neck when a patient is experiencing difficulty swallowing. If VitalStim can improve dysphagia therapy then the patients should be able to swallow more effectively, therefore reducing the number of illnesses and deaths caused by dysphagia. This research paper reviews VitalStim intervention for adults with dysphagia in order to find out whether or not VitalStim is more effective than traditional techniques and to discover what the best treatment for dysphagia in adults is.

### **Treating Dysphagia with Electrical Stimulation**

Based on the available research electrical stimulation therapy appears to be more effective than using traditional techniques alone. Blumenfeld, Hahn, LePage, Leonard, and Belafsky (2006) evaluated the efficacy of transcutaneous electrical stimulation versus traditional dysphagia therapy, because they believed that using electrical stimulation (ES) to treat adults with dysphagia is more effective than using traditional dysphagia therapy (TDT) to treat adults with dysphagia. The researchers retrospectively evaluated 80 hospital patients to compare ES to TDT. Each therapy group consisted of 40 patients, 40 undergoing ES and 40 undergoing TDT. A swallowing assessment was administered to each patient at admission and prior to discharge. During the assessment

videofluoroscopy and fiberoptic endoscopic evaluation were used to assess each patient's swallow. Each patient's swallow was then gauged by a swallow function severity scale. The severity scale is based on the safest tolerable ingestible material and ranged from 0 to 6 with 0 being a profound swallow and 6 being a normal swallow with no impairments. After assessment patients were then divided into the two therapy groups. According to Blumenfeld et al. (2006), the traditional dysphagia therapy (TDT) group received a combination of therapeutic exercises, compensatory maneuvers, and diet modifications to improve the swallow mechanism by increasing strength, endurance, range of motion, and mobility of oral and laryngeal musculature. Exercises included any combination of laryngeal adduction and elevation exercises, Shaker exercises, and oral motor exercises. Compensatory techniques and diet modifications were unique to each patient based on the patient's assessment. The patients of the TDT group performed the assigned exercises continuously for 30 minutes. The patients in the electrical stimulation group did not receive any of the same therapy techniques that the TDT group received but only received ES. Blumenfeld et al. (2006) primary objective was to activate pharyngeal/laryngeal musculature through intact peripheral

nerves using electrical stimulation therapy. Each patient within this group received electrical stimulation for 30 minutes and received increased intensity until a motor response was observed. TDT and ES treatment sessions were discontinued when the patients met their stated goals according to their care plans or when a patient's progress plateaued. At the end of treatment, the researchers compared pretreatment and post-treatment swallow scores were compared. "Both groups showed significant improvement in swallow severity score after treatments. The electrical stimulation group, however, displayed significantly more improvement than did the TDT group" (Blumenfeld et al., 2006, p. 756). In this study, the group that received electrical stimulation experienced greater improvement in a shorter amount of time than did the group that received traditional dysphagia therapy. These results show that electrical stimulation may be a more effective treatment for dysphagia in adults than traditional techniques alone.

Kiger, Browns, and Watkins (2006) investigated patient outcomes using VitalStim (electrical stimulation) compared to traditional swallow therapy. The researchers explored this topic because they wanted to know if VitalStim is more effective than traditional techniques, if VitalStim patients have less consistency restrictions, and if



VitalStim patients advance more quickly from non pharyngeal oral feedings to oral feedings. Twenty-two patients with pharyngeal or oral/pharyngeal dysphagia were involved in this study. The patients were divided equally into two groups: the control group which received traditional swallowing therapy and the experimental group which received VitalStim therapy. The control group consisted of 5 males and 6 females with ages ranging from 45 to 91 years. The experimental group consisted of 7 males and 4 females with ages ranging from 18 to 81 years. The traditional swallowing techniques used to treat the control group consisted of oral motor exercises, pharyngeal swallowing exercises, use of compensatory strategies while eating, or thermal/tactile stimulation. Each group was evaluated preceding and following treatment. A certified speech language pathologist (SLP) evaluated the patients using either videofluoroscopic swallowing study (VFSS) or fiberoptic endoscopic evaluation of swallowing (FEES) to evaluate each of the patients' change in swallowing function. After evaluating a patient, the SLP then assigned a severity rating to the oral and pharyngeal phases of the swallow. The researchers' rating scale ranged from 1 to 7, 1 being profound and 7 being normal/minimal impairment. The calculation of change in each patient's score was based on

the initial and final VFSS or FEES. Scores for both the pharyngeal and oral stage of swallowing was examined. The researchers also took diet consistency advancement/change into consideration. The experimental group had an average change score of 0.3 in the oral stage. The control group had a higher average change score of 1.5 in the oral stage. Thus, the control group using traditional techniques showed evidence of a greater change in the oral stage of swallowing. When assessing the pharyngeal stage scores, the experimental group had an overall change of 1.1 and the control group had an overall change of 2.3. Once again, the control group displayed a greater overall change. This evidence appears to indicate that control group showed a greater improvement in the oral phase than the experimental group, but the results were not statistically significant for the pharyngeal phase (Kiger et al., 2006). The results for change in diet consistency and no pharyngeal oral intake to oral intake were also not statistically significant. This investigation by Kiger, Brown, and Watkins failed to confirm that VitalStim Therapy is more effective than using traditional swallowing therapies.

Carnaby-Mann and Crary (2007) conducted a meta-analysis study examining the evidence on neuromuscular electrical stimulation (NMES) for swallowing because they

believed that NMES therapy would improve swallowing. Carnaby-Mann and Crary (2007) conducted a literature search, identifying all articles published between 1966 and 2006. They limited the search by reviewing participants, study type, intervention type, and outcome measures. Criterion for the studies included: participants with a secondary diagnosis of oropharyngeal dysphagia, ages 18 years and older, and the use of transcutaneous NMES for swallowing treatment. Gender and time post-onset were not included in the criterion. Carnaby-Mann and Crary grouped and rated the studies by giving each study a rating based on best-evidence synthesis. Based on this rating each study was classified as strong, moderate, limited, indicative, or insufficient evidence. The researchers also classified the studies using quantitative analysis, study diversity, effect size, and heterogeneity. The researchers thoroughly examined 81 studies to ensure that the studies met their selection criteria. After examining each study, only 7 studies met the researchers' selection criteria. The seven studies included 255 patients with dysphagia who received NMES treatment. The studies each included a mix of age, gender, and etiology. NMES treatment outcome measures included: a swallowing scale, weight gain, functional intake, residue on a fluoroscopic study, and laryngeal

elevation. After evaluating heterogeneity, methodological quality analysis, and quantitative analysis of the studies, Carnaby-Mann and Crary (2007) found a statistically significant summary effect size supporting the use of NMES in the treatment of swallowing disorders. Carnaby-Mann and Crary were able to analyze statistically multiple studies related to the effectiveness of neuromuscular stimulation. The evidence appears to indicate that electrical stimulation is beneficial for adults with dysphagia.

Leelamanit, Limsakul, and Geater (2002) investigated synchronized electrical stimulation in treating pharyngeal dysphagia because they believed that "synchronous contraction of the thyrohyoid muscle by electrical stimulation during swallowing would improve dysphagia resulting from reduced laryngeal elevation" (Leelamanit et al., 2002, p.2204). The study included 23 patients who presented with reduced laryngeal elevation (RLED). The patients were only allowed to participate in the study if they had not resonded to alternate treatment for at least 2 months. The patients were composed of 11 males and 12 females who had dysphagia symptoms 3 to 12 months before the study. Their ages ranged from 35 to 87. Each patient then had to meet the researchers' diagnostic criteria for reduced laryngeal elevation. The Leelamanit et al. (2002)

diagnostic criteria consisted of history of dysphagia and aspiration, wet phonation or aspiration and coughing during wet swallow, palpation noting reduced laryngeal elevation, and videofluoroscopic swallowing study (VFSS) showing laryngeal penetration and/or aspiration, reduced laryngeal elevation, and narrow pharyngoesophageal segment. Within this study, researchers used an electrical stimulator created by the researchers themselves, called the SES (synchronized electrical stimulator). The SES was designed with two primary functions: measurement and stimulation. Each patient received SES treatment 4 hours per day. Patients continued SES treatment until they met criteria for improved swallow or until other intervention was required. Leelamanit et al. (2002) improved swallow criteria consisted of increased ability to swallow more than 3ml of water without aspiration or coughing, adequate oral intake and weight gain, and VFSS showing no laryngeal penetration and aspiration, improved laryngeal elevation, and width of pharyngoesophageal segment increased to at least half of its normal width. Out of the 23 patients, 20 of them improved enough to meet the researchers' improved swallowing criteria. The patients who met this criteria were able to swallow and eat without aspiration. Therefore, the researchers confirmed their hypothesis, and

demonstrated that simultaneous electrical stimulation is beneficial in treating pharyngeal dysphagia.

Shaw, Sechtem, Searl, Keller, Rawi, and Dowdy (2007) investigated the use of transcutaneous neuromuscular electrical stimulation (VitalStim) for patients with severe dysphagia because they wanted to demonstrate whether or not VitalStim is effective for patients with severe dysphagia. This study consisted of 18 patients with dysphagia. The gender ratio was 12 males and 6 females. Each patient was evaluated by an SLP prior to treatment. The evaluations consisted of a modified barium swallow or endoscopic evaluation of swallow and a bedside evaluation. The evaluations investigated the diet status of each patient, aspiration or penetration, residue, and laryngeal elevation. After completing a pre-treatment evaluation, each patient was assigned a dysphagia severity score. After the patients were evaluated, they then began VitalStim therapy with therapy sessions lasting for 1 hour. The number of sessions provided depended on the patient's response to VitalStim. Upon completion of therapy, the patients then underwent a post-treatment evaluation. The evaluation evaluated diet status, aspiration/penetration, laryngeal elevation, swallow delay, and dysphagia severity score. The researchers then compared the pre-test and post-

test evaluation scores. The researchers also divided the patients into two groups, group A and group B, depending on their dysphagia severity pre-treatment scores. Group A consisted of patients with lower severity ratings and Group B consisted of patients with a more severe dysphagia score. Prior to therapy, 10 out of 18 patients consumed all consistencies of food and 5 patients were no pharyngeal oral (NPO). The results show that 50% of the patients who consumed all consistencies of food improved their dysphagia score after receiving VitalStim, and 2 of the 5 patients who were NPO improved their overall dysphagia score. No improvement was shown in the other patients. "The most impressive improvement was seen in those patients who, before therapy, were predominately fed enterally but were able to consume a small amount of food of any consistency safely" (Shaw, Sechtem, Searl, Keller, Rawi, & Dowdy, 2007, p. 39). This group consisted of 7 patients, and 6 of these 7 were able to discontinue tube feedings. After evaluating all aspects of the swallow, diet status, residue, aspiration/penetration, and dysphagia score, the results showed that the entire group had statistically significant improvement. The evidence tends to support the conclusion that VitalStim is most beneficial for patients with mild to moderate dysphagia. Despite the fact that patients with

severe dysphagia may not improve from VitalStim therapy, this investigation still suggests that VitalStim therapy is effective in treating some patients with dysphagia.

### **Electrical Stimulation used in Conjunction with Traditional Techniques**

It is also believed that electrical stimulation is more effective when used in conjunction with other techniques. Jin-Woo Park, Oh, Lee, Sung-Joon Park, Yoon, and Kwon (2009) researched the impact of effortful swallowing training coupled with electrical stimulation on hyoid elevation during swallowing. The researchers investigated this topic because they believed that the training of effortful swallow in conjunction with electrical stimulation would increase the degree of hyoid elevation in healthy individuals. The researchers recruited 16 healthy volunteers between the ages of 21 and 30. The volunteers were randomly assigned into two groups of eight, each containing four males and four females. The participants did not have any neurologic, phonologic, psychiatric, speech, or swallowing disorders. The volunteers participated in a single-blind, randomized, controlled study for a total of four weeks. Before beginning therapy, baseline data was obtained for each patient using surface electromyography (sEMG) which



measured muscle activity during the swallow. Researchers also measured hyoid bone excursion using videofluoroscopy (VFS). After obtaining baseline data, the participants then received electrical stimulation therapy for two weeks, which was followed by sEMG and VFS to assess the effects of the electrical stimulation therapy. The participants received no treatment during the last two weeks of therapy. The researchers did not administer therapy the last two weeks of therapy to determine the long-term effects of electrical therapy. The electrical stimulation therapy that the participants received was performed using the Microstim, "a two channel functional electrical stimulation device for neuromuscular rehabilitation" (Kwon et al., 2009, p.297). The electrodes were placed to target the sternohyoid muscles. The intensity of stimulation varied within each group. The control groups' intensity was increased until the patient felt a tingling sensation, whereas the experimental groups' intensity was increased until muscle contraction was visible. The participants received electrical stimulation therapy once per day for 20 minutes on each weekday. This totaled ten 20-minute sessions of electrical stimulation for two weeks. During the electrical stimulation therapy, the participants had to forcefully swallow 2 ml of water every 10 seconds while

stimulation was being applied. During the forceful swallow of water the surface EMG and peak amplitude was measured three times using a MedelecSynergy instrument. The movement of the hyoid bone was also measured using videofluoroscopy. During the VFS participants were again asked to forcefully swallow 2 ml of barium three times. The researchers then analyzed the hyoid movement using a PiView STAR program. Overall, sEMG amplitude, sEMG area, x-axis values, and y-axis values of the hyoid bone were obtained for comparison at pretreatment, immediately post-treatment, and 2 weeks after ending treatment. After completing forceful swallowing training, the peak amplitude of the sEMG immediately post-treatment and 2 weeks after treatment increased compared with the baseline data in six of the eight subjects in the experimental group. However, the responses were not statistically significant. The control group displayed no difference between the peak amplitudes. Initially, there was increased elevation in hyoid movement (y-axis movement) in the experimental group, but this elevation declined 2 weeks after ending treatment. The control group did not display a difference in increased elevation of hyoid movement. Both groups displayed no significant difference in degree of x-axis movement. While Kwon et al. (2009) demonstrated an increase in hyoid

elevation immediately post-treatment using electrical stimulation paired with effortful swallow training, a two week training period may not be a sufficient amount of time for the therapy to work efficiently. Also, the researchers were unable to show a sustained increase in hyoid elevation 2 weeks after ending treatment, demonstrating that using electrical stimulation paired with effortful swallow training for only two weeks will not increase hyoid elevation for a lengthy period of time.

Lim, Lee, Lim, and Choi (2009) investigated the impact neuromuscular electrical stimulation and thermal-tactile stimulation on adults with dysphagia because they believed that neuromuscular electrical stimulation (NMES) therapy paired with thermal-tactile stimulation (TTS) would improve dysphagia symptoms caused by stroke. According to Lim et al. (2009) TTS increases oral awareness by rubbing the anterior faucial pillars with a cold probe before having a patient swallow. Thirty-six stroke patients with a swallowing disorder were involved in this study. To qualify for the study, each patient had to have a diagnosis of stroke and dysphagia, a score of 21 or higher on the Mini-Mental State Examination, and had to be medically stable. The participants were then divided into two groups. The

experimental group was administered neuromuscular electrical stimulation in conjunction with thermal tactile stimulation, whereas the control group was only treated with thermal tactile stimulation. The NMES was administered by a trained occupational therapist, who used a Dual Channel VitalStim unit to provide therapy to the patients within the experimental group. The patients receiving VitalStim participated in therapy 5 times per week for one hour sessions. The TTS was also administered by an occupational therapist. All patients received TTS five times per week. Lim et al. (2009) reported that the participants' swallowing functions were assessed using three systems: the swallowing function scoring system, the Rosenbek penetration-aspiration scale, and pharyngeal transit time. The measurement were administered for baseline and at the end of the 4 weeks of treatment. The researchers also evaluated the patient's discomfort during treatment, their satisfaction of treatment, and the tube feeding ratio among the groups. Overall, 28 of the 36 patients completed treatment; 16 in the control group and 12 in the experimental group. The control group consisted in 14 men and 2 women, whereas the experimental group consisted of 10 men and 2 women. At the end of treatment, the researchers found that patients in the experimental

group had a substantially higher satisfaction rate than the patients in the control group, but discomfort scores within the two groups did not differ statistically. However, the swallowing function scores within the two groups changed significantly. Initially, there was no difference between the two groups, but after therapy the experimental groups' swallowing function scores changed from 2 to 4, and the controlled groups' scores changed from 3 to 4, which is not statistically significant. The experimental groups' penetration-aspiration scale also displayed a statistically significant improvement. The control groups' penetration-aspiration scale also improved but were not statistically significant. The overall pharyngeal transit time showed improvement within both groups. The last assessment measured was tube to oral feedings. Six out of the 12 tube-fed patients within the experimental group progressed to oral feeding, while only one out of the seven tube-fed patients within the control group progressed. The evidence of this research supports the conclusion that neuromuscular stimulation combined with thermal tactile stimulation is more effective in treating stroke patients with dysphagia than using thermal tactile stimulation alone.

### **Conclusion**

Although much remains to be learned about VitalStim,

evidence now available suggests that using electrical stimulation to treat patients with dysphagia is a beneficial treatment option. The evidence appears to indicate that VitalStim is more effective in treating dysphagia in adults than using traditional techniques alone. One of the previous investigations failed to confirm the hypothesis that VitalStim is a beneficial treatment for patients with dysphagia. This failure to support the evidence may be due to the limited time that electrical stimulation was administered. Therefore, when using VitalStim to treat dysphagia SLPs should adhere to VitalStim protocol for the most beneficial results. There is limited research on VitalStim paired with traditional techniques. Therefore, the hypothesis that VitalStim is more effective when used in conjunction with other techniques is inconclusive and should be further investigated by SLPs before being administered. In summary, many patients with dysphagia seem to benefit from electrical stimulation therapy.

Although research tends to support electrical stimulation therapy, additional research is required to support this relatively new treatment option. Future investigations of VitalStim should consider the duration of improvement after electrical stimulation treatment has

ceased. Researchers should not only consider the benefits of VitalStim but for how long these results last and what is the best alternative if the results do not last. Also, researchers should consider the number of times a patient can receive VitalStim if results decline over time. Future research should also investigate the use of VitalStim paired with other dysphagia therapy techniques. Research should not just investigate the benefits of electrical stimulation alone but investigate the benefits of VitalStim used in conjunction with other therapy techniques, such as oral motor exercises, compensatory strategies, or thermal/tactile stimulation. Future research investigations should also explore what ages can benefit from electrical stimulation therapy and if age affects the results of therapy. Finally, researchers should investigate whether patients with oral stage dysphagia can benefit from electrical stimulation therapy. Researchers should explore the idea of VitalStim being an alternative treatment option for oral phase dysphagia rather than using traditional techniques alone. Further investigations of VitalStim will help strengthen decisions about using electrical stimulation to treat patients with dysphagia.

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