

Effect of Application of Transcutaneous Electrical Nerve Stimulation and Laryngeal Manual Therapy in Dysphonic Women: Clinical Trial

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Summary: Objective. To verify the effect of the Transcutaneous Electrical Nerve Stimulation (TENS) and of Laryngeal Manual Therapy (LMT) and to compare the two techniques in relation to vocal/laryngeal symptoms, pain, and vocal quality after these resources were administered in dysphonic women.

Study Design. Control trial.

Method. A total of 20 women with bilateral vocal nodules participated. All of the volunteers underwent investigation of vocal/laryngeal symptoms, musculoskeletal pain, and vocal register. The volunteers were subdivided into: 1. TENS Group (10 volunteers)—TENS application; 2. LMT Group (10 volunteers)—LMT application; both groups received 12 sessions of treatment, twice a week, lasting 20 minutes each. After treatment, the initial assessments were repeated. Data were statistically analyzed by Wilcoxon and signal test ($P < 0.05$).

Results. After TENS, there was significant improvement in the “high pitched voice” and “effort to speak” symptoms; there was significantly lower frequency of pain in the posterior neck and shoulder; TENS significantly reduced the intensity of pain in the posterior neck, shoulder, and upper back. The auditory perceptual analysis showed improvement only in the strain parameter after TENS. After LMT, there was improvement of the “sore throat,” significantly lower incidence of pain in the anterior neck, and the pain intensity in the posterior neck decreased.

Conclusion. When compared with the LMT, TENS appeared to be a treatment method intended to be used as a complement to voice therapy, considering the parameters evaluated and controlled.

Key Words: TENS–Dysphonia–Massage–Voice–Larynx.

INTRODUCTION

Hyperfunctional voice disorders associated with prolonged, strong contraction of the larynx muscles are commonly associated with high laryngeal position in voices that have a strong component of muscle tension.^{1–3}

Prolonged phonation in the presence of increased laryngeal muscle tension causes excessive force on the physiology of the vocal tract and can lead to changes in its function and changes in the mucosa, such as nodules, polypoid degeneration, and chronic laryngitis.^{4,5} Specifically, the presence of vocal nodules is a difficult condition to study and treat, especially when the etiology is not fully understood.⁶ Clinically, it has been observed that sometimes the vocal nodules are associated with changes defined as muscle tension dysphonia (MTD).^{7–10}

MTD is defined as a voice disorder that is characterized by excessive force on the laryngeal and perilaryngeal muscles^{7,8,10,11} with incomplete glottic closure, median constriction of the vocal folds, median constriction in the laryngeal vestibule, change in vocal fold mucosa, high larynx, tension in the suprahyoid muscles, breathiness, vocal attack, and strained

voice with changes in resonance.^{5,10–12} Recently, MTD was defined as a clinical and diagnostic term describing a spectrum of disorder of vocal folds behavior caused by increased muscle tension and was considered a “bridge” between functional and organic dysphonia.¹³

Although many causal factors and methods of diagnosis have been described,¹⁴ the literature shows the use of only a few techniques that have been proven effective in the treatment of dysphonia associated with hyperfunctional disorders.¹³ Thus, we describe the use of techniques that prioritize the relaxing of the larynx such as the circumlaryngeal manual therapy^{10,15,16} and Laryngeal Manual Therapy (LMT).^{2,17} The main goal of manual therapy in the laryngeal and perilaryngeal area is to relax the excessively tense muscles that ultimately inhibit balanced phonation, such as the high position of the larynx in the neck that can influence phonation by changing the length control function and stiffness of the vocal folds, contributing to the imbalance in voice quality.^{2,10,13,18–21}

A literature review conducted in 2011¹³ indicates other treatment options for MTD such as indirect therapy: vocal hygiene and patient education; direct therapy: voice therapy and Circumlaryngeal Manual Therapy; medical treatment; and surgery for secondary organic lesions.

Specifically, for the treatment of patients with vocal nodules, another study⁶ suggests using standardized protocols to improve data comparisons in the treatment of patients. The authors suggest five phases for the treatment: vocal hygiene; relaxation exercises; respiratory exercises; direct facilitation with reduction of loudness and yawn-sigh, which is a frequently used approach for reducing muscular tension, decreasing effort,

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and reducing abruptness of vocal onset, thereby helping to reduce vocal hyperfunction; and carryover: with the aim to transfer the newly learned vocal behaviors to real-life situations outside of the therapy setting.

In recommending laryngeal relaxation and shoulder girdle in individuals with hyperfunctional dysphonia, the application of transcutaneous electrical nerve stimulation (TENS) may be an effective therapeutic tool. This resource involves the application of percutaneous electrodes aiming to excite the nerve fibers by means of an electric current with a typically biphasic waveform, symmetric or asymmetric, which can be transmitted through the skin without interruption. TENS uses pulses with low or high frequencies that can vary from one to over 100 Hz and also variable pulse widths, which can be brief or not, depending on the way one wishes to use the stimulation.^{22,23}

It is noteworthy that the electrical current TENS described in this study differs from other types of electrical currents used to treat swallowing and dysphonia by speech therapists, such as neuromuscular electrical stimulation (NMES) or transcutaneous electrical stimulation (TES) with reports of improvement in voice quality.^{24–27} The main purpose of the electrical stimulation was to treat cervical pain that often occurs in these patients.

The objective of the current TENS as described in this study is to promote muscle relaxation of the perilaryngeal and cervical areas with the placement of surface electrodes on suprahyoid muscles and superior fibers of trapezius muscles (Figures 1 and 2). This is done with low frequency and high intensity current, whereas in studies using other types of currents, the stimulation is performed directly on perilaryngeal muscles in the hyoid bone area, thyrohyoid membrane and even in the region of the cricothyroid muscle to recruit the cricothyroid muscle fibers and then improve glottic closure.^{24–27}

TENS is widely used by physical therapists for muscle relaxation and symptomatic treatment of musculoskeletal pain in various body parts. Besides analgesia, TENS is able to promote improved vascularization in the application area and assists in muscle relaxation.^{28,29} With an analgesic purpose, whether the pain is from an acute injury or due to chronic processes,^{23,29,30} TENS is one of the simplest forms of electrotherapy and one of the most used techniques in the field of electrotherapy.²³ With regard to the treatment of dysphonia in which the muscular tension is present, there is only one study in the literature that the authors observed in which the exclusive application of TENS provided a significant improvement of pain in the cervical muscles and of vocal quality for women with muscle tension dysphonia. However, the authors affirmed that further studies are needed to better understand the muscle and vocal behavior after the application of this resource.³¹

The aim of this study highlights the need to develop further research with TENS and LMT in individuals with voice problems, and to develop more research on the effect of the application of both techniques in dysphonic individuals. The objective of this clinical, controlled, and prospective study was to verify the effect of TENS and LMT application and to compare the two techniques in relation to vocal and laryngeal symptoms,

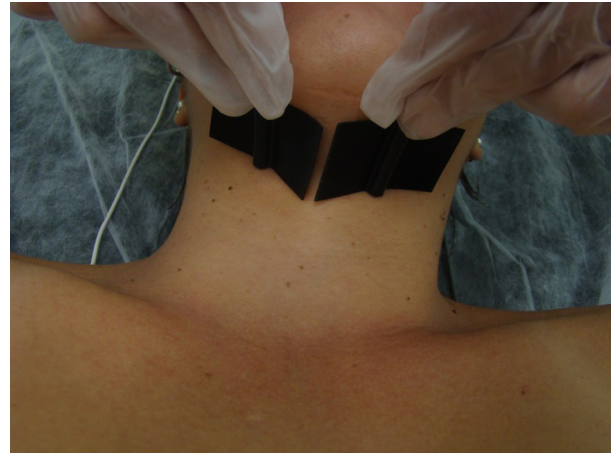


FIGURE 1. Surface electrodes on submandibular area during TENS stimulation.

pain, and vocal quality after these resources were administered in dysphonic women.

METHODOLOGY

Sample

This research protocol was approved by the Ethics Committee in Research of the University (CEP/FOB/USP 099/2011). For this study, 20 women were selected, aged 18–45 years old. The calculation of the sample size was based on the study of Lagorio, Carnaby-Mann, and Crary²⁵ that considered a value of $P < 0.05$ ($\alpha = 5\%$) and a test force of 90% ($\beta > 0.90$), which indicates the need of six individuals.

To form the groups, women were sought who were enrolled for vocal treatment in the Department of Speech and Language Pathology Clinic, FOB/USP, and who were complaining of vocal disorders. To participate in the study, the volunteers had to present complaints of voice alteration, altered voice evidenced by an auditory perceptual pre-assessment, bilateral vocal nodules or mucosal thickening, and incomplete glottic closure, as evidenced by the otolaryngology evaluation.

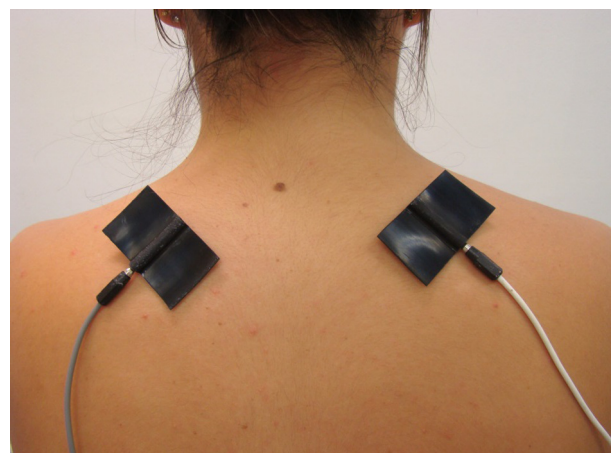


FIGURE 2. Surface electrodes on trapezius—upper fibers muscle during TENS stimulation.

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