Intensive Versus Traditional Voice Therapy for Vocal Nodules: Perceptual, Physiological, Acoustic and Aerodynamic Changes

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Summary: Objectives. To investigate the perceptual, physiological, acoustic, and aerodynamic outcomes of patients with vocal nodules following intensive voice treatment compared with traditional voice treatment.
Study Design. Pragmatic randomized clinical trial.
Methods. Fifty-three women diagnosed with bilateral vocal nodules participated in the study. Voice recordings, stroboscopic recordings, acoustic, and aerodynamic assessments were made before voice treatment, after vocal hygiene education, and immediately postvoice treatment. All participants completed one session of vocal hygiene and eight sessions of direct voice therapy, however the delivery of the treatment between the two groups differed in treatment intensity.
Results. Physiological improvements were observed after vocal hygiene alone, whereas physiological, perceptual, and acoustic parameters all improved to some degree in both treatment groups immediately posttreatment. There were no differences in the extent of change observed between the two groups at any point following treatment.
Conclusions. The investigation provided initial evidence that individuals with vocal nodules are able to recover voice function, vocal health, and vocal communication through intensive voice treatment. The results suggest comparable positive perceptual, physiological, and acoustic outcomes from intensive voice therapy compared with traditional voice therapy. Further investigation is required to determine the long-term effects of intensive treatment.
Key Words: Vocal nodules–Voice treatment–Perception–Physiology–Acoustic–Aerodynamic.

INTRODUCTION

Vocal nodules are benign lesions of the vocal folds caused by repetitive mucosal injury leading to histological changes and concomitant voice mutation.[1] Their presence causes changes to the vibratory pattern of the vocal cords because of an increase in vocal fold mass and can impact vocal fold adduction both anteriorly and posteriorly to the nodule.[2] The resultant dysphonia is perceived as breathy with various degrees of turbulent noise, strained vocal quality, roughness, instability and vocal fry/creak, with a tendency toward a low pitch.[2–4]

Individuals with vocal nodules constitute a large part of the client population at voice clinics.[5] The voice disturbances can cause personal problems and societal losses, as individuals with vocal nodules in professions with high voice demands are forced to take long periods of sick leave and sometimes may have to change careers.[5,6] As a consequence, extensive research has been conducted on the efficacy of treatment for vocal nodules, with voice therapy recommended as first-line treatment.[5,7–14]

Behavioral intervention has been shown to have a positive impact on vocal nodules, with a number of studies confirming a marked reduction or complete elimination of the nodules posttreatment.[5,7,8,11,15–20] Evidence also confirms that voice quality significantly improves postvoice therapy.[7,8,10,19,21] Positive outcomes have also been reported across a range of acoustic measures, with jitter, shimmer, signal-to-noise ratio, fundamental frequency (F_0), maximum phonation time (MPT), and mean airflow rate positively correlated with voice improvement following treatment for vocal nodules.[7,8,12,19]

Although most of the research conducted to date has demonstrated the positive effects voice therapy has on vocal nodules, there is considerable variation in the duration and intensity of the therapy provided. In fact, no report has provided evidence or clear guidelines as to the optimal intensity or duration of voice therapy for clients with this vocal pathology.[5,8,11,14,16,19] Studies have reported voice treatment protocols which include two to 16 sessions,[12] once per week for 12 weeks,[18] twice weekly for 2 to 4 months,[16] and 4 to 6 months in duration.[8]

For voice therapy to be effective, both motor learning and cognitive processes for maintenance and transfer of the new vocal behavior should be considered. According to Schmidt and Lee,[22] motor learning is a set of processes associated with practice or experience leading to relatively permanent changes in movement. Practice conditions include the following: amount and distribution of practice, the variability of practice, the scheduling of practice with several different tasks, and part versus whole practice. These independent variables affect the learning of motor skills. One variable which may have an effect on learning and has not been widely investigated, is the distribution of practice. Practice distribution refers to how a given amount of practice is distributed over time,[23] and may be described as massed or spaced practice. In massed practice, all the practice periods occur very closely together with little or no rest time in between sessions. In a spaced practice schedule, the time interval between the practice periods is increased significantly.[24]

Accepted for publication June 5, 2014.
Preliminary data relating to the perceptual, acoustic, and aerodynamic data from this article were presented at the 2013 National Conference of Speech Pathology Australia and the 29th World Congress of the IALP in 2013.
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Journal of Voice, Vol. 29, No. 2, pp. 260.e31-260.e44
0892-1997/$36.00

http://dx.doi.org/10.1016/j.jvoice.2014.06.005

Few empirical data exist on the effects of practice distribution in speech motor learning. The strongest evidence exists for massed practice. For example, the Lee Silverman Voice Treatment (LSVT), which incorporates principles of multiple repetition, high intensity, and high frequency of practice (four treatment sessions per week for 4 weeks), has been shown to result in long-term vocal improvements in the speech and voice of people with Parkinsons disease.[25,26] It is postulated that this treatment facilitates intensive motor relearning, maximizes motor output and effort, increases drive and goal directed activity, and enhances sensory awareness to promote internal cueing, self monitoring, and upscaling of motor output.[27]

The benefits of massed, intensive practice were also noted in the treatment of functional dysphonia.[28,29] In a concept article, the authors provided a framework and indications for delivery of intensive short-term voice therapy, referred to as "boot camp".[28] This involved concentrated practice, using a variety of voice therapy techniques, delivered in a concentrated time frame (1 to 4 days with 4 to 7 hours of therapy per day). This type of therapy was reported to be tailored to the nature of the voice disturbance and individual specific needs, thereby maximizing the individual's ability to learn and carryover targets to nonclinical environments. The authors stated that this approach can be successfully used with various types of dysphonia, especially those who have not been successful with traditional voice treatment approach, and with clients living at geographical distances sufficiently far from voice centers.[28] However, clinical trials have not yet been conducted on the "boot camp" treatment approach. Patel et al[28] speculated that the nature of the high-intensity training may better mimic cognitive, motor, and physiological requirements of activities of daily living than traditional therapy.

Potential advantages of intensive treatment are that: rigorous practice (overload) is possible; simultaneous interventions can be conducted for multiple components involved in voice production; and opportunities for specificity, individuality, and facilitating transfer of learned skills which may influence patient compliance are readily available.[29] Thus in translating this evidence to the management of vocal nodules, it is possible that intensive voice therapy (IVT) may be more beneficial than traditional treatment protocols, and offer greater speed and efficiency in achieving improvement in vocal function. To date no study has explored the relative efficacy of intensive treatment specifically for individuals with vocal nodules. Therefore, the aim of the present study was to investigate the perceptual, physiological, acoustic, and aerodynamic outcomes of patients with vocal nodules after intensive voice treatment when compared with traditional voice therapy (TVT). It is hypothesized that greater improvement in perceptual, physiological, and acoustic parameters will occur following intensive voice treatment for vocal nodules compared with TVT.

METHODS

Ethics approval for the study was obtained from the Taipei Veterans General Hospital and The University of Queensland Medical Research Ethics Committee.

Participants

Fifty-three women (mean age 37.5 years, range 20–54) referred from the outpatient clinic at the Department of Otorhinolaryngology Department, Taipei Veterans General Hospital, Taiwan, and diagnosed with bilateral vocal nodules were included in the study. The diagnoses of vocal nodules were made by one of five otolaryngologists from videostroboscopic examination, whereas the severity of dysphonia was determined by one speech-language pathologist (SLP) experienced in the area of voice and blind to the study purpose. Overall severity was rated using the "Grade" scale from the GRBAS (Grade, Roughness, Breathiness, Asthenia, Strain) scale[30] (where 0, normal; 1, mild; 1.5, mild-to-moderate; 2, moderate; 2.5, moderate-to-severe; and 3, severe) and was based on evaluation of a sample of reading (a standard Mandarin passage). Participants were included in this study if they: (1) were aged between 18 years and 55 years; (2) had normal articulation, resonance, and language ability; (3) had normal hearing as determined by a screening test at 20 dB HL at three frequencies 500, 1000, 2000 Hz; (4) had no previous professional singing or speaking training; and (5) had no previous voice therapy or laryngeal surgical treatment. Exclusion criteria included: (1) use of prescription medication which may cause changes in laryngeal function, mucosa, or muscle activity (list provided by National Center for Voice and Speech [NCVS][31]); (2) current psychiatric or neurologic conditions; or (3) a history of allergies, lung disease, or other concomitant vocal pathology (eg, vocal polyp and vocal cyst).

Participants were matched in pairs according to their age, occupation, and severity of dysphonia. The duration of dysphonia before treatment was not taken into consideration. The participants occupations were categorized into nonprofessional voice users (eg, factory workers, students, catering, clerical workers, home carers, and the unemployed) versus professional voice users (eg, teachers, health professionals, and sales personnel). All participants were diagnosed with bilateral broad-based nodules before treatment. Participants in each pair were then assigned to either of two treatment groups according to their availability: IVT or TVT groups. Thirty-one participants were recruited to the intensive voice program. Seven withdrew or failed to complete the full program (for health, work, or personal reasons), leaving 24 participants who completed the IVT program. A total of 37 participants were recruited to the TVT program group. Eight withdrew or failed to complete the entire program, leaving 29 participants who completed the entire TVT program. Demographic information of the 53 participants who completed both programs is detailed in Table 1.

Comparisons of baseline characteristics between the two groups were conducted using independent *t* tests for parametric data (age, acoustic, and aerodynamic measurements) and chi-square tests and Mann-Whitney *U* tests for nonparametric data (occupation, severity of dysphonia, existence of vocal fold edema, and vocal nodule location). There were no statistical differences between the groups with regards to their age ($t = -0.165$, $P = 0.871$), severity of dysphonia ($Z = -1.861$, $P = 0.063$), or occupation ($\chi^2 = 0.053$, $P = 0.817$) at presentation. With respect to pretreatment acoustic and aerodynamic