The Effect of Head Position and/or Stance on the Self-perception of Phonatory Effort

***Marina Gilman and †Michael M. Johns,** **Atlanta, Georgia; and †Los Angeles, California*

Summary: Background. Vocal fatigue is a common but poorly defined complaint of patients presenting with voice disorders. Definitions of vocal fatigue generally include increased self-perceived phonatory effort resulting from references to vocal loading or prolonged voice use resulting in deterioration of function. The present study looks at the role of posture, specifically head position and stance, in self-perceived phonatory effort.

Methods. Forty-six healthy adults, 13 males and 33 females (mean age was 27.5), with no history of vocal problems/disorders within the past year were recruited. Subjects were asked to sustain the vowel /a/ at a comfortable pitch and loudness for 5–10 seconds in each of six positions: sitting and standing in the manner habitual for each subject, two exaggerated positions of the head (head back and head forward), and two exaggerated positions in standing (standing with knees locked and with knees soft). Each position was repeated three times in randomized order, resulting in 18 trials for each subject. After each repetition of the sustained /a/, subjects were asked to rate their experience of vocal effort using a 100-mm visual analog scale (0–40 least effort, 40–60 habitual effort, and 60–100 increased effort).

Results. Repeated measures analysis of variance revealed significant difference in the self-perceived phonatory effort levels across positions (P value < 0.001). The exaggerated forward and back head positions in both sitting and standing positions showed the greatest significance on the Tukey *post hoc* tests ($P < 0.000$).

Conclusions. Based on the findings, posture may play a more important role in vocal fatigue than previously thought.

Key Words: vocal fatigue–vocal effort–voice disorders–mechanisms–posture.

INTRODUCTION

Vocal fatigue and increased vocal effort are common complaints of patients presenting with voice problems. These complaints may or may not relate to pathological findings on laryngeal examination. Many patients complain of vocal fatigue at the end of the day or following vocally demanding activities. Additional complaints may include deterioration of vocal function, reporting that voice becomes hoarse or weak, or experience of reduced range.[1] However, there is a subset of individuals, many of whom are actors or singers, who complain of fatigue or increased vocal effort after only short periods of voice use. The complaints of vocal fatigue are often, although not always, associated with performance. Alterations in head position are often observed, such as bringing the head forward when attempting to project or, in the case of classically trained singers, bringing the head back when singing or presenting a monologue. These patients will often lock their knees while standing, resulting in a shift in the position of the pelvis and possibly increased tone in the abdominal muscles limiting breath support. For these patients, vocal load is not the issue. Sometimes, there is also a mild deterioration of function but the major complaint is increased effort.

Accepted for publication November 30, 2015.

Preliminary results were presented at the 2011 Voice Foundation Annual Symposium in Philadelphia.

Disclosure: The authors have no financial or nonfinancial disclosures.

From the *Speech-Language Pathology, The Emory Voice Center, Department of Otolaryngology, Emory University, Atlanta, Georgia; and the †USC Voice Center, University of Southern California, Los Angeles, California.

Address correspondence and reprint requests to Marina Gilman, Speech-Language Pathology, The Emory Voice Center, Department of Otolaryngology, Emory University, 550 Peachtree Street NE Suite 9/4400, Atlanta, Georgia 30308. E-mail: marina.gilman@emoryhealthcare.org

Journal of Voice, Vol. 31, No. 1, pp. 131.e1–131.e4

0892-1997

http://dx.doi.org/10.1016/j.jvoice.2015.11.024

It is well understood in the field of vocology that vocal fatigue and vocal effort are intertwined and as such are ill defined. Reported symptomatology of vocal fatigue includes increased phonatory effort generally reported to be correlated with prolonged voice use, increased vocal load, deterioration of vocal function such as reduced pitch and dynamic range, perilaryngeal discomfort or pain, and difficulty controlling vocal quality.[1–3]

Titze[4] suggested that there are at least two aspects of vocal fatigue: first, *laryngeal muscle fatigue* related to the physiology of laryngeal muscle strength and contractile and metabolic properties; and the second, *laryngeal tissue fatigue* related to the response of laryngeal tissue to phonotrauma from increased vocal loading. Welham and Maclagan,[5] in their review of the literature, define vocal fatigue as "negative vocal adaptation that occurs as a consequence of prolonged voice use." Solomon[1] considers "the self report of an increased sense of effort with prolonged phonation" with or without observable or measureable decreases in phonatory function to be a major characteristic of vocal fatigue. Both of these definitions include prolonged voice use as a defining characteristic of vocal fatigue. What then is the significance of reported vocal fatigue or vocal effort in some patients after only brief periods of voice use?

Current research has accepted the importance of vocal load as a defining criterion for vocal fatigue. Vocal loading tasks have consistently been used in investigations of laryngeal muscle fatigue,[6] tissue resistance as assessed by aerodynamic measures of phonation threshold pressure,[6–10] and the acoustic instrumental and clinician perceptual assessment.[11–16] A few studies have suggested that postural deviations can contribute to a sense of increased vocal effort.[17–21] These studies analyzed changes in general muscle tonicity using balance platforms or motion analyzers during tasks involving high vocal load or changes pre and post therapeutic intervention. Findings included displacement of the head either forward or backward,[10,11,17] increased

hypertonicity,[17] and forward bending of the trunk together with backward rotation of the head changing the cervicocephalic angle.[10,11] However, few of these studies included the personal perception of the subject with regard to phonatory effort.[7,9,10,14]

The current study poses the research question: Do shifts in posture, that is, alterations in head position forward of backward or standing with knees locked or with knees soft have an effect on self-perceived phonatory effort? To limit the number of variables, subjects were asked to produce a sustained /a/ at a comfortable pitch and loudness level for about 5 seconds. In this way, articulatory input and vocal loading as contributing factors were eliminated. The only variable was the position of the head and the configuration of the pelvis and the spine.

METHODS

This study was approved by the Emory University Institutional Review Board.

A 100-mm visual analogue scale was used to assess self-perceived phonatory effort. Forty-six normal healthy adult subjects, 13 males and 33 females (mean age was 27.5), were recruited for this study. The inclusion criteria were no history of vocal problems/disorders within the past year and overall good health.

Six physical positions were used for this study: sitting and standing in the manner habitual for each subject, two exaggerated positions of the head while sitting (head back and head forward), and two exaggerated positions while standing (standing with knees locked and with knees soft). The habitual sitting and standing positions were used as baseline positions to account for individual postural bias. The neutral positions taken by each subject provided the limits for individual postural bias with regards to the position of the head and the knees when standing. It is expected that they would perceive reduced sense of effort when phonating in a manner closer to their habitual position.

Subjects were asked to sustain the vowel /a/ at a comfortable pitch and loudness for at least 5 seconds in each of the six different positions: sitting in their habitual manner, sitting with the head in a self-perceived exaggerated forward position, sitting with the head in a self-perceived exaggerated back position, habitual stance, standing with knees locked, and standing with knees soft. Each position was repeated three times in randomized order, resulting in 18 trials for each subject. After each repetition of the sustained /a/, subjects were asked to rate their experience of vocal effort by marking a 100-mm visual analog scale (0–40 least effort, 40–60 habitual effort, and 60–100 increased effort). In this way, they were afforded a few moments of vocal rest.

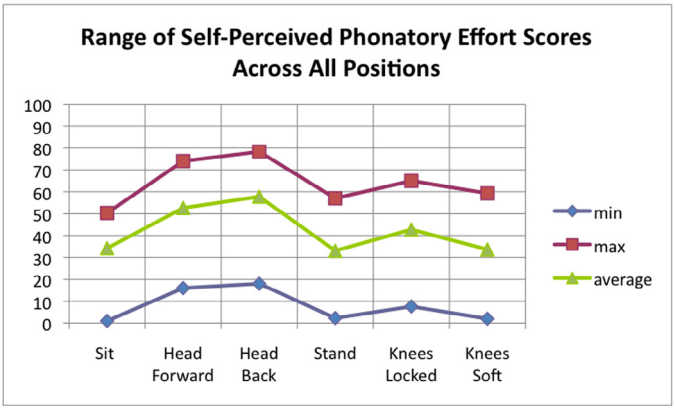
RESULTS

Statistical analysis

Difference in the self-perceived phonatory effort levels across positions was assessed by analysis of variance. Tukey tests were conducted subsequently to assess pairwise differences in the effort levels. *P* values less than 0.05 were considered statistically significant.

Results

Effort scores were averaged across the three repetitions. The range of self-perceived phonatory effort in sitting with the head in a habitual position was 1–50, with a mean score of 34, and a standard deviation (SD) of 13.8, compared with sitting with the head forward with a range of 16–74, mean score of 52, and SD of 15.7 and compared with sitting with the head back with a range of 18–78, mean score of 57, and SD of 14.5. In the standing positions, the range of self-perceived phonatory effort scores were as follows: standing in the habitual manner 2–57, mean score of 38, and SD of 15.9; effort scores with the knees locked 8–65, mean score of 43, and SD of 15.5; and effort scores in the standing position with the knees soft 2–59, mean score of 34, and SD of 15.5 (see Chart 1).



Repeated measures analysis of variance revealed significant difference in the self-perceived phonatory effort levels across positions (P value < 0.001). Given this statistical significance and medium-to-large effect size, *post hoc* tests were conducted based on estimated marginal means to detect significant pairwise differences between positions. Tukey tests showed that there were significant differences in the effort levels when positions were paired with the exaggerated head positions whether sitting or standing, $P < 0.000$. Significant differences were not as great in the standing with knees locked *vs.* head forward pair (P value = 0.026) and the neutral standing *vs.* knees locked pair (P value = 0.028). It is interesting to note that there was a difference between standing with knees soft and knees locked (P value = 0.049).

Only three pairs did not show any significance: habitual sitting compared with habitual standing pairs (P value = 0.999), head back compared with head forward pairs (P value = 0.579), and habitual sitting compared with standing with knees locked pairs (P value = 0.081). The habitual standing *vs.* standing with knees soft self-perceived phonatory effort levels were not significantly different. This is not surprising as these are generally considered the default positions for that individual. Both the exaggerated head positions showed significance only when compared with the other positions, not when compared with each other.

DISCUSSION

The results of this study suggest that head position, either forward or back of the individual's habitual position, may be a factor in