Efficacy of Six Tasks to Clear Laryngeal Mucus Aggregation

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Summary: Purpose. Clinicians commonly teach patients alternative clearing behaviors to reduce coughing and hard throat clearing with the assumption that these behaviors clear mucus from the vocal folds. Yet there is limited evidence of the effectiveness of these alternative behaviors at clearing mucus. This study's purpose was to evaluate the efficacy of reducing laryngeal mucus aggregation using alternative approaches in comparison with hard coughing and hard throat clearing in people with and without voice disorders.

Method. Mucus aggregation of 46 participants, 22 with and 24 without voice disorders, was evaluated from stroboscopy recordings taken before and after each of six clearing behaviors: hard coughing, hard throat clearing, silent coughing, soft throat clearing, dry swallowing, and swallowing with a fluid bolus. Each participant performed each clearing behavior twice. Two trained raters evaluated mucus aggregation for type, thickness, and pooling.

Results. Of the six clearing behaviors studied, only hard throat clearing changed vocal fold mucus aggregation. The features of mucus aggregation that were changed by hard throat clearing were the severity of mucus thickness and the presence of type 3 mucus.

Conclusions. Despite the widespread clinical use of alternative clearing behaviors, the results of this study indicate that hard throat clearing is the only clearing behavior to have a significant impact on removing mucus aggregation from the vocal folds. This finding should be further investigated in a larger scale study. If the results of this study are replicated, clinicians should consider changing their use and description of alternative clearing behaviors in clinical practice.

Key Words: voice–larynx–mucus–throat clear–cough.

INTRODUCTION

A thin layer of laryngeal mucus is considered necessary to maintain healthy vocal fold tissue.[1] This thin, clear mucus is in contrast to mucus aggregation commonly seen in patients with voice disorders, which is typically opaque, thicker, and more abundant.[2] Mucus aggregation can occur as a protective reaction and is believed to be part of the healing process. This increased laryngeal mucus can cause patients to cough and/or clear their throat to clear the mucus. It is believed that this can progress into a harmful cycle of habitual coughing and throat clearing that can cause vocal fold edema through tissue shearing, friction, and contact forces, and perpetuate or cause a voice disorder.

Patients with voice disorders frequently complain about laryngeal mucus and associated chronic, habitual coughing and throat clearing during their evaluation. More than 4 million patients with voice disorders present with habitual coughing and throat clearing.[3–6] Mucus aggregation in these patients is often visible during laryngeal endoscopy with or without stroboscopy. Patients with voice disorders have been found to have larger amounts of mucus that is thicker in comparison with those of healthy controls.[2] Speech-language pathologists (SLPs) and laryngologists attempt to reduce laryngeal mucus complaints by advocating for increased hydration and discussing the importance of extinguishing the habitual clearing behaviors. Often alternative behaviors, believed to be less harmful, are promoted to provide the patient with a replacement for the behaviors believed to be harmful.

Silent coughing, soft throat clearing, dry swallowing, and swallowing a fluid bolus of water are the four most common alternative clearing behaviors used. Despite their common use in the voice clinic, there is no evidence of their ability to clear mucus from the vocal folds. The purpose of this study was to evaluate the efficacy of reducing laryngeal mucus aggregation by these alternative approaches in comparison with hard coughing and hard throat clearing in people with and without voice disorders.

METHOD

Participants

Forty-six people, 22 with and 24 without voice disorders, participated in this study. There were 15 women without voice disorders, 9 men without voice disorders, 13 women with voice disorders, and 9 men with voice disorders who participated. The average age for the participants were 40.5 years for vocally normal women, 37.9 years for vocally normal men, 40.3 years for women with voice disorders, and 40.7 years for men with voice disorders. The age ranges were 27–59 years for vocally normal women, 30–59 years for vocally normal men, 24–60 years for women with a voice disorder, and 27–59 years for men with a voice disorder. People were categorized as being with or without a voice disorder based on voice quality of life survey,[7] perceptual judgment of voice quality, participant interview, self-categorization, and endoscopy with stroboscopy completed by an SLP who specializes in voice disorders. The diagnoses of people with voice

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TABLE 1.
Type of Voice Disorder, V-RQOL Score, and Number of Participants With Each Disorder for All Persons Included in This Study

Patient ID	V-RQOL Score	Type of Disorder
1	16	Right polyp, left reactive nodule, left bowing
2	24	Muscle tension dysphonia, left bowing
3	29	Left polyp, right reactive nodule, bilateral generalized edema
4	25	Left recurrent paralysis, bilateral generalized edema
5	13	Bilateral muscle tension dysphonia, erythema, and edema
6	24	Nodules, erythema, prominent vascularization
7	15	Left bowing, laryngopharyngeal reflux
8	15	Glottal insufficiency, left bowing
9	36	Bilateral diffuse edema and varices, anterior glottal gap
10	30	Bilateral edema medially
11	23	Bilateral polypoid degeneration
12	28	Right bowing, mild tremor, intermittent medial glottal gap
13	14	Left pseudosulcus, mild glottal insufficiency
14	10*	Bilateral edema, erythema, and muscle tension dysphonia, pseudosulcus
15	19	Right cyst, left reactive nodule, bilateral prominent vascularization, anterior glottal gap
16	15	Mild bilateral edema and erythema
17	12	Left hemorrhage, cyst with a polyp underneath, bilateral glottal gap
18	23	Postop nodule removal, bilateral irregular leading edges, glottal gap, adynamic segments
19	18	Postop right polyp removal, anterior erythema
20	45	Bilateral polypoid lesions
21	12	Pedunculated ventricular cyst extending to impede vocal fold contact
22	11	Bilateral bowing, anterior gap, muscle tension dysphonia

* Patient's complaints focused on singing voice.
Abbreviation: V-RQOL, voice-related quality of life.

disorders and their voice-related quality of life scores are displayed in Table 1. Participation in the study was accepted through an informed consent form. The clinical data for this study were collected at the Charlotte Eye Ear Nose and Throat Associates specialized voice center in Charlotte, North Carolina. The SLPs involved with data collection were specifically trained in voice. The data collection, storage, and use were in accordance with human subjects regulations.

Instrumentation and procedures

We used a digital Rhino-Laryngeal Stroboscopic System Model 9100B (KayPentax, Lincoln Park, NJ, USA) with a 70-degree rigid endoscope (KayPentax, Model 9106) to visualize the vocal folds. We used stroboscopy, instead of continuous light endoscopy, as it has been shown to be superior for the visualization of mucus.[8] Two sustained phonations of /i/ for each participant for each trial of each clearing task were recorded. One recording was conducted before the task and the other immediately after. Participants were instructed to phonate at habitual pitch and loudness levels. The duration of the sample was dependent on the ability of the participant to sustain phonation.

Participants underwent a series of 12 clearing behavior trials with each behavior assessed twice. The clearing behaviors were elicited in a standardized order with the first behavior counterbalanced, using the Latin square approach, across groups (people with and without voice disorders). This allowed for all of the tasks to be elicited in the first position. After the first tasks, tasks were elicited in the *a priori* determined standardized order: hard coughing, hard throat clearing, silent coughing, soft throat clearing, swallowing, and swallowing with a fluid bolus of water. This allowed for all tasks to be elicited in all positions. This standardized order was chosen to prevent differences in participant response due to an anticipated position effect. That is, this method allows for the evaluation of all participants having undergone the same clearing task before the one elicited so that there is not a differing response across participants due to the prior task. The same clinician provided verbal instructions and an example of each task for all of the participants. For example, the clinician described a silent cough and then modeled one. There was no required training for the participant. However, if the participant did not accurately produce the instructed task, that trial was discarded and the task was elicited again until the participant accurately produced the correct task. Instruction for the swallowing with a fluid bolus of water was "take a sip of water from the water bottle." A self-selected bolus size was used and, therefore, the amount of water was not standardized across participants.

Mucus ratings

Visual judgments from stroboscopy of mucus aggregation type, pooling, and thickness were made using *Alvin* software.[9] Mucus aggregation was classified, as in Hsiao, Liu, and Lin,[10] into three types (Figure 1). Type 1 was defined by a rough surface of the vocal fold and by mucus threads between the vocal folds noted during open phase. Type 2 was defined as mucus bubbles visible on phonation and resembling vocal fold nodules. Type 3 was