Effectiveness of Chewing Technique on the Phonation of Female Speech-Language Pathology Students: A Pilot Study

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Summary: Objectives. The purpose of this study was to determine how use of the vocal facilitating technique, chewing, affected the phonation of speech-language pathology (SLP) students.
Study Design. A pretest-posttest randomized control group design was used.
Methods. Twenty-seven healthy female SLP students were randomly assigned into either an experimental group or a control group. The experimental group practiced chewing exercises across 18 weeks, whereas the control group received no vocal facilitating techniques. Both groups completed pre- and post- objective voice assessment measures (aerodynamic measurement, acoustic analysis, voice range profile, and Dysphonia Severity Index). Differences between pre- and post-data were compared between the experimental and control group using an independent sample *t* test.
Results. Compared to the control group, chewing resulted in a significant decrease in jitter and noise-to-harmonic ratio (NHR), a significant increase in fundamental frequency (f_o), a significant expansion of the voice range profile, and a significant increase in Dysphonia Severity Index (DSI). Shimmer and maximum phonation time (MPT) were not significantly different between groups.
Conclusions. The results of this pilot study suggest that the vocal facilitating technique, chewing, may improve objective vocal measures in healthy female SLP students.
Key Words: Chewing–Voice–Facilitating technique–Effectiveness–Phonation–Speech-language pathology students–Dysphonia–Objective vocal measures–Pilot study.

INTRODUCTION

The vocal facilitating technique, chewing, was first described by Froeschels[1] in 1943. He based the technique on the observation that someone can chew and speak at the same time. According to the author, chewing and speaking must be somewhat identical because both functions require the same muscles and nerves.[2] In 1956, Beebe[3] confirmed Froeschels observations and described voiced chewing as an inborn and intuitive behavior. Voiced chewing refers to the "raw material" used instinctively by the aboriginal human inhabitants of the earth.[2] It serves the dual purpose of supporting life (eating) and oral communication (speech).[3] Because of etiquette, the voice has not been used in conjunction with chewing food for thousands of years. Despite this, voicing while chewing can still be easily accomplished by individuals.[2]

The most convincing support of voiced chewing as an inborn and intuitive behavior is found in clinical experience. A natural behavior such as chewing may facilitate improved vocal production[4] through relaxation of the vocal tract[5] and regulation of the basic vocal pitch.[6] According to Weiss and Beebe,[7] chewing also improves coordination between respiration and phonation. Froeschels[1,3] described improved vocal quality during chewing aloud in individuals with vocal fold paresis, cyst, and papilloma as well as in those suffering from hypo-or hyperfunctional voice disorders, mutational disorders, and hearing impairment. Furthermore, Brodnitz and Froeschels[8] facilitated the resolution of vocal nodules after the using of chewing in five of the six subjects under study. Boone et al[5] recommend the technique for patients with muscle tension dysphonia who speak with tension, hard glottal attacks, and restricted mandibular movements. According to Weiss and Beebe,[7] chewing might also be useful in treating speech disorders such as stuttering and dysarthria. However, to our knowledge, no studies confirm this finding. Weiss and Beebe[7] further described the application of chewing to train the healthy speaking and singing voice.

The use of the chewing technique in improving vocal production has mainly been supported by the results of case studies that cannot be easily generalized. Additionally, conclusions are based on observations and anecdotal clinical experience. Furthermore, a detailed description of the method is lacking and much of the published literature is outdated.[1–8] More recently, larger efficacy studies are available but those have examined chewing as part of a broader therapy program, rather than in isolation.[9–16] Therefore, experimental studies that specifically examine the effect of chewing on vocal production are required.

Our pilot study aimed to make a first contribution to this research gap. We wanted to investigate if the outdated and unproven assertions[1–8] about the effect of chewing may be correct. Therefore, in this first-stage investigation, we chose to focus on chewing as a technique that could facilitate and train the healthy voice.[7]

The purpose of this study was to determine how use of the vocal facilitating technique, chewing, affected the phonation

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of healthy women enrolled in a speech-language pathology (SLP) program. A positive effect on the SLP students' vocal capacities was hypothesized because, according to the literature,[1–8] chewing may facilitate a more natural vocal production through relaxation of the vocal tract, regulation of the basic vocal pitch, and better coordination between respiration and phonation.

MATERIAL AND METHODS

This study was approved by the human subjects committee of Ghent University.

Subjects

Twenty-nine female students enrolled in the first year of the bachelor program Speech-Language Pathology at Ghent University were randomly selected to participate in this study. Exclusion criteria included diagnoses of mental health conditions, voice disorders, nasal and ear diseases, and physically-limiting diseases that might interfere with study completion. Additionally, individuals who had previously participated in voice therapy or training were excluded from participation. To determine that participants were not currently suffering from a voice disorder or nasal or ear disease, each subject was assessed by an otorhinolaryngologist and audiologist performing a nasopharyngeal and laryngeal evaluation, videolaryngostroboscopy, otoscopy, and audiometry. On the basis of these results, two students were excluded because of vocal fold edema and vocal fold nodules.

The remaining participants included a homogeneous group of twenty-seven healthy female students with a mean age of 18.8 years (SD, 0.8 years; range, 17.9–21.2 years). They were randomly assigned into either an experimental group ($n = 14$) or a control group ($n = 13$). The experimental group practiced chewing exercises across 18 weeks, whereas the control group received no vocal facilitating techniques. Randomization was based on the first letter of the students' last name (A–M, control group; N–Z, experimental group). There were no differences between the two groups in mean age (Mann–Whitney U test; $P = 0.239$).

Material and methods

Voice questionnaire. At the beginning of the study, each subject filled in a questionnaire based on the voice assessment protocol of the European Study Group on Voice Disorders[17] to describe vocal complaints and risk factors.

Objective vocal measures. Both groups completed pre- and post- objective voice assessment measures. Data were collected by two SLPs (E.D.C. and H.N.) in a sound-treated room at Ghent University Hospital.

Aerodynamic measurement. To measure the maximum phonation time (MPT), the participants were asked to sustain the vowel /a/ at their habitual pitch and loudness in free field while seated. The MPT was modeled by the experimenters, and the participants received visual and verbal encouragement to produce the longest possible sample. The length of the sustained vowel was measured in seconds. The best trial of three attempts was retained for further analysis.

Acoustic analysis. The fundamental frequency (f_o), jitter (%), shimmer (%), and noise-to-harmonic ratio (NHR) were obtained by the Multi Dimensional Voice Program from the *Computerized Speech Lab* (CSL, model 4300, Kay Elemetrics Corp., Lincoln Park, NJ). The subjects were instructed to produce the vowel /a/ at their habitual pitch and loudness. A midvowel segment from 3 seconds registered with a sampling rate of 50 kHz was used.

Voice range profile. The voice range assessment was performed with the *CSL* following the procedure outlined by Heylen et al.[18] This assessment includes determination of the highest and lowest fundamental frequency and intensity. The participants were instructed to produce the vowel /a/ for at least 2 seconds using, respectively, a habitual pitch and loudness, a minimal pitch, a minimal intensity, a maximal pitch, and a maximal intensity. Each production was modeled by the experimenters, and the participants received visual and verbal encouragement.

Dysphonia Severity Index. The Dysphonia Severity Index (DSI)[19] is a multiparameter approach designed to establish an objective and quantitative correlate of the perceived vocal quality. The DSI is based on a weighted combination of the following parameters: MPT (in seconds), highest frequency (F-high, in Hz), lowest intensity (I-low, in dB), and jitter (in %). The DSI is constructed as 0.13 MPT + 0.0053 F-high − 0.26 I-low − 1.18 jitter + 12.4. The index ranges from −5 to +5 for severely dysphonic to normal voices. The more negative the index, the worse is the vocal quality. A DSI of 1.6 is the threshold separating normal voices from dysphonic voices.[20] The DSI can be calculated as a percentage[20] by increasing the value with five points and then multiplying it by 10. A higher percentage indicates a better vocal quality.

Facilitating technique chewing. The experimental group received the facilitating technique chewing during 18 weeks. In the first 8 weeks, the group participated in weekly 1-hour training sessions organized by the experimenters. The experimenters provided verbal information, examples, and corrective feedback. Incorrect posture or poor respiratory technique were corrected. The content of the training sessions, based on the procedure outlined by Boone et al,[5] can be found in Table 1. In addition to the exercises during training, the subjects were instructed to practice the chewing technique at home twice a day during 10 minutes.

From week 9–17, the subjects repeated the technique independently at home with a frequency of two times 10 minutes a day. Meanwhile, they had the opportunity to contact the experimenters for feedback or questions.

In week 18, an interactive rehearsal session was organized under the guidance of the experimenters. In this session, subgroups (two or three subjects) of the experimental group presented one of the steps learned in training. The other subjects followed their instructions.