



Effect of two isolated vocal facilitating techniques glottal fry and yawn-sigh on the phonation of female speech-language pathology students: A pilot study

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ABSTRACT

Objective: The purpose of this study was to determine the effect of two isolated vocal facilitating techniques, glottal fry and yawn-sigh, on the phonation of vocally healthy female speech-language pathology (SLP) students.

Study design: A multigroup pretest–posttest design was used.

Methods: A group of thirty-six healthy female SLP students with a mean age of 18.1 years were assigned into three groups: a glottal fry group (practicing the facilitating technique glottal fry across 18 weeks, $n = 12$), a yawn-sigh group (practicing the facilitating technique yawn-sigh across 18 weeks, $n = 12$) and a control group (receiving no facilitating techniques, $n = 12$). To compare vocal measures before and after this training period, an identical objective voice assessment protocol (maximum performance task, acoustic analysis, voice range profile and Dysphonia Severity Index) was performed in the three groups. Groups were compared over time using linear mixed models. Within-group effects of time were determined using post hoc pairwise comparisons.

Results: Glottal fry resulted in a significant decrease in lowest and highest intensity. Yawn-sigh resulted in a significant increase in fundamental frequency, a significant decrease in shimmer and noise-to-harmonic ratio, and a significant increase in highest intensity.

Conclusions: Yawn-sigh may have a positive effect on the phonation of female vocally healthy future SLPs, whereas results are less supportive for using glottal fry in training this population's voice.

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1. Introduction

Glottal fry and yawn-sigh are listed by Boone and McFarlane (1988) as techniques that may facilitate a more optimal vocal response in dysphonic patients. According to the authors, especially voice disorders characterized by vocal hyperfunction, such as muscle tension dysphonia, vocal nodules, polyps, spasmodic dysphonia and ventricular phonation, may benefit from the techniques (Boone, McFarlane, Von Berg, & Zraick, 2010).

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Glottal fry (also referred to as *vocal fry*, *basal register*, *pulse register*, *glottalization*, *crackling voice*, *creaky voice* or *stroh bass*) is the lowest vocal register characterized by frequencies ranging from 20 to 80 Hz, irregular oscillations and pulse-like vibrations with relatively long periods of glottal closure and tightly adducted vocal folds (Abdelli-Beruh, Drugman, & Red Owl, 2016; Blomgren, Chen, Ng, & Gilbert, 1998; Boone et al., 2010; Chen, Robb, & Gilbert, 2002; Cielo, Elias, Brum, & Ferreira, 2011; De Bodt, Heylen, Mertens, Vanderwegen, & Van de Heyning, 2008; Doellinger, Berry, & Berge, 2005; Nix, Emerich, & Titze, 2005; Oliveira, Davidson, Holczer, Kaplan, & Paretzky, 2016; Slifka, 2006; Titze, 2000; Wolk, Abdelli-Beruh, & Slavin, 2012; Yuesa, 2010). This pulse-like vibratory pattern of low frequency results in a vocal quality accompanied by creaking, cracking, and popping noises (Abdelli-Beruh, Wolk, & Slavin, 2014). A literature review of Cielo et al. (2011) showed that glottal fry is predominantly produced by the action of the thyroarytenoid muscle (especially its inner portion), which gets shortened, dropping the mucosa in great volume along the free edge, increasing subglottic pressure, reducing airflow, and increasing jitter, shimmer and noise levels of the acoustic signal. Other authors mentioned decreased subglottic pressure when producing glottal fry (Blomgren et al., 1998; Boone et al., 2010; Chen et al., 2002; Nix et al., 2005; Titze, 2000). According to Boone et al. (2010), glottal fry has therapeutic indications due to its production with minimal airflow and subglottic pressure, relaxed vocal folds and reduced friction between the folds.

Remarkably, glottal fry has mainly been considered a perceptual, and often diagnostic, vocal parameter instead of a therapeutic technique (Chen, Hsiao, Hsiao, Chung, & Chiang, 2007; Gibson & Vertigan, 2009; Gottliebson, Lee, Weinrich, & Sanders, 2007; Hartelius, Theodoros, Cahill, & Lillvik, 2003; Iwarsson & Petersen, 2012; Nguyen, Kenny, Tran, & Livesey, 2009; Ross, Noordzji, & Woo, 1998; Vertigan, Theodoros, Winkworth, & Gibson, 2008). Perceptually, a distinction has been made between persistent or sporadic presence of glottal fry, respectively associated with vocal pathology or non-pathological communicative roles (Cielo et al., 2011). The persistent use of glottal fry is often considered harmful and may represent vocal hyperfunction (Cielo et al., 2011; Gottliebson et al., 2007). It often co-occurs with other signs such as hoarse, harsh and rough vocal qualities (Blomgren et al., 1998). Besides, daily communication requires sufficient volume and projection that is impossible to achieve in this register; the attempt to raise the intensity in glottal fry may then in turn build up vocal tension (Cielo et al., 2011). On the other hand, several authors (Abdelli-Beruh et al., 2014; Abdelli-Beruh et al., 2016; Oliveira et al., 2016; Slifka, 2006; Wolk et al., 2012; Yuesa, 2010) have shown that glottal fry is sporadically present in healthy adult American-English speakers, particularly when vocalizing words occurring at the end of sentences. Only a few authors (Bolzan, Cielo, & Brum, 2008; Pimenta, Dájer, Hachiya, Tsuji, & Montagnoli, 2013), besides Boone et al. (2010) and Cielo et al. (2011), considered glottal fry a facilitating technique and investigated its immediate effects on the voice. Bolzan et al. (2008) found an improvement in glottal closure and in the amplitude of the vocal folds' mucosa vibration immediately after glottal fry in females with an incomplete glottal closure. However, a worsening in the perceptual evaluation of the voice and increased jitter and noise were also measured. Pimenta et al. (2013) found a decreased closing phase and, unlike Bolzan et al. (2008), decreased jitter in healthy females after producing glottal fry for 1 min. Using glottal fry in singing training seems controversial as well (Nix et al., 2005). Some authors describe its usefulness to extend the low range of baritones and basses (Brown, 1996; Leyerly, 1986; Stark, 1999), or to encourage spontaneity of voice onset, decrease compensatory muscle behaviors, and shape the glottal configuration and epilarynx to optimize vocal output (Nix et al., 2005), whereas others do not even mention glottal fry in their books or are very outspoken in rejecting the technique (Reid, 1983). Thus, few studies examined glottal fry as a facilitating technique and the existing literature shows conflicting results.

Yawn-sigh, on the contrary, has been cited frequently as an efficient facilitating technique, especially for patients with hyperfunctional dysphonia (Boone & McFarlane, 1988; Boone et al., 2010; Brodnitz, 1968; Casper, Colton, Woo, & Brewer, 1990; Colton & Casper, 1990; Moncur & Brackett, 1974; Pershall & Boone, 1985). The technique has been shown to reduce muscular tension in the vocal tract by lowering the larynx and widening the supraglottal airway (Boone & McFarlane, 1988; Boone & McFarlane, 1993; Boone et al., 2010; Boone, 1991; Brodnitz, 1968; Casper et al., 1990; Colton & Casper, 1990; Duan et al., 2010; Dworkin, Meleca, & Abkarian, 2000; Holmberg, Hillman, Hammarberg, Södersten, & Doyle, 2001; Moncur & Brackett, 1974; Moore, 1990; Nelson, 2003; Pershall & Boone, 1985; Schneider & Sataloff, 2007; Shrivastav, Yamaguche, & Andrews, 2000; Wilson, 1979). Titze and Verdolini Abbott (2012) suppose yawn-sigh may be a good combination for some voice therapy because sigh involves a glottal posture with low glottal impedance that matches a 'yawny' vocal tract, which is a wide epilarynx tube and pharynx. Phonating in that way appears to be produced with a slight glottal opening, the opposite of excessive vocal fold compression often seen in patients with vocal hyperfunction (Boone & McFarlane, 1993). Boone (1991) introduced the "invisible yawn-sigh" (with the mouth closed) for relaxing the vocal tract in healthy subjects who experience a tense voice in public situations. Though often cited as a facilitating technique and used for more than 20 years in voice therapy, the effectiveness of yawn-sigh remains unclear. The existing literature is limited because studies either investigated the effects during a one-time performance of yawn-sigh in healthy participants (Boone & McFarlane, 1993; Shrivastav et al., 2000) or investigated the technique as part of a broader therapy program in dysphonic patients (Carding, Horsley, & Docherty, 1998; Duan et al., 2010; Holmberg et al., 2001).

The literature overview demonstrates the need for studies that investigate the effect of glottal fry or yawn-sigh in isolation (rather than within a broader therapy or training program) and over a longer time span (rather than during a one-time performance). In this pilot study, a vocally healthy subject sample was selected for an initial exploration of the potential facilitating effects of both techniques. Healthy future occupational voice users, namely SLP students, were recruited as they may benefit from learning techniques that facilitate their voice, both during their education as well as their future job performance. The vocal demands of SLPs require special skills that go beyond the everyday conversational level (Van Lierde et al., 2010; Van Lierde et al., 2011). Previous research has shown that SLP students have a borderline vocal quality

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