

Tutorial

Chronic Cough: A Tutorial for Speech-Language Pathologists

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There is emerging evidence for the efficacy of speech pathology intervention for individuals with chronic cough (CC) that persists despite medical treatment, but there are limited resources available to assist speech-language pathologists to manage this perplexing condition. The purpose of this article is to outline a treatment approach for speech pathology management of CC. The article provides an overview of medical treatment for CC, a profile of patients with CC including the association with paradoxical vocal fold movement, voice problems, and psychological issues. A protocol for management of this condition including evaluation, treatment, patient education, and the importance of motivation and compliance are provided. This article provides a practical orientation for clinicians who are less experienced in managing individuals with CC.

Chronic cough (CC) is defined as a cough persisting for longer than 8 weeks (Pratter, Brightling, Boulet, & Irwin, 2006). Although there are multiple etiologies for CC and complexities surrounding its management, the majority of individuals with CC respond to medical management. There is emerging evidence to support the effectiveness of speech pathology treatment for CC that persists despite medical management (Blager, 2000; Gay, Blager, Bartsch, & Emery, 1987; Murry, Tabae, & Aviv, 2004; Russell, 1991; Vertigan, 2001). Individuals with CC are generally not referred to speech pathologists until their cough is judged to be refractory to medical treatment and therefore represent a skewed proportion of the total population with CC. The theoretical basis and efficacy of speech pathology intervention for CC have been reported in previous studies (Vertigan, Theodoros, Gibson, & Winkworth, 2006a, 2006b). There is however a need for resources that outline treatment protocols to assist speech pathologists in their management of individuals with CC. The objectives of this article is to provide an overview of medical management of CC, describe the typical profile of adults with CC, and outline a protocol for assessment and management of adults with CC from the speech pathologist's perspective.

DEFINITION AND TERMINOLOGY

Cough can be classified as either acute or chronic. Chronic cough can be subdivided into cough that responds to medical treatment and cough that is refractory to medical treatment. Chronic cough can be refractory to medical treatment in up to 20% of cases (Ing & Breslin, 1997; Kardos, 2000; Lawler, 1998; Marchesani, Cecarini, Pela, & Sanguinetti, 1998), and a number of labels such as psychogenic habit cough (Gay et al., 1987), idiopathic cough (McGarvey, 2005), psychogenic cough (Pierce & Watson, 1998), habit cough (Blager, Gay, & Wood, 1988), and refractory cough (Murry et al., 2004) have been used to describe this condition. This range of terms may reflect the underlying beliefs in the etiology of persisting cough. In this article the term CC will be used to describe cough that persists despite medical management.

MEDICAL MANAGEMENT OF CHRONIC COUGH

Medical management of CC involves measuring the severity of the condition and determining

the underlying cause (Chung, 2003b). The most common causes of CC are smoking, lung pathology, medications such as angiotensin converting enzyme (ACE) inhibitors, asthma, postnasal drip syndrome, and gastroesophageal reflux (GER) disease. Within the field of respiratory medicine, CC is managed according to the anatomic diagnostic protocol (ADP) (Irwin et al., 1998). This protocol encompasses a systematic approach to identifying and treating the suspected underlying etiology or etiologies of the cough through specific diagnostic testing and empiric treatment trials.

The ADP commences with the history and physical examination. If the history identifies the use of medications such as ACE inhibitors then alternative medications may be used. A chest radiograph and spirometry are then performed. If no primary pulmonary pathology is identified then diagnostic testing or empiric therapy for postnasal drip syndrome, asthma, and GER are instigated. If the cough resolves following treatment for any of these conditions then these factors are presumed to have been the cause of the cough. Speech pathologists rarely become involved in the management of patients whose cough is successfully managed according to this process.

A number of causes have been proposed for cough that persists despite medical treatment based on the ADP, and they are listed in Table 1. Speech pathology management is not widely recognized as a treatment option for CC that does not respond to medical management, and current literature in the field of respiratory medicine has not embraced speech pathology intervention as a potential management option.

DESCRIPTION AND CHARACTERISTICS OF CHRONIC COUGH

The nature of CC that persists despite medical management has received limited research attention. The duration of the CC can range from months to over 20 years (Haque, Usmani, & Barnes, 2005), and patients may be frustrated at the ineffectiveness of previous medical treatment. The typical presentation is a dry irritated cough that is triggered from the throat and occurs in bouts throughout the day; however, there is variation in the description and pattern of the cough (Vertigan, Theodoros, Gibson, & Winkworth, 2007). The specific characteristics of the cough appear to have limited diagnostic value (Mello, Irwin, & Curley, 1996; Smith, Ashurst, Jack, Woodcock, & Earis, 2006).

TABLE 1. Causes for cough that persists despite medical treatment.

Cause	Reference
Nonacid reflux	(McGarvey, 2005)
Persisting PNDS requiring sinus CT	(McGarvey et al., 1998)
Familial sensory neuropathy	(Haque et al., 2005), (McGarvey, 2005)
Tuberculosis	(Pratter et al., 2006)
Bronchiectasis	(Pratter et al., 2006)
Occult interstitial lung disease	(Pratter et al., 2006)
Endobronchial tumors	(Pratter et al., 2006)
Sarcoidosis	(Pratter et al., 2006)
Superlative lower airway infection	(Pratter et al., 2006)
Eosinophilic or lymphocytic bronchitis	(Pratter et al., 2006)
Swallowing disorders	(Pratter et al., 2006)
Persisting postviral cough	(Chung, 2003a)
Congestive heart failure	(Pratter et al., 2006)
Habit cough	(Pratter et al., 2006)
Paradoxical vocal fold movement	(Newman & Milgrom, 1995)
Psychogenic cough	(Kastelik et al., 2005)

Note. PNDS = postnasal drip syndrome; CT = computerized tomography

The majority of individuals with CC perceive little warning before their cough episodes, although some report that they cough deliberately in response to laryngeal sensations (Vertigan et al., 2007). Many patients with CC can identify triggers to their cough while others are unable to identify any triggers. Cough triggers may be classified as inhaled (e.g., smoke and fumes), temperature (including cold air or humidity), intrinsic (e.g., a sensation in the throat or anxiety), or activity (such as talking or physical exercise) (Vertigan et al., 2007). The majority of patients with CC perceive that they are unable to control their cough. Although they may have previously attempted strategies to control their cough, many feel these strategies are ineffective. Approximately 50% of individuals with CC habitually mouth breathe, which can have a drying effect on the larynx and potentially contribute to laryngeal irritation and trigger further coughing (Vertigan et al., 2007).

Paradoxical Vocal Fold Movement

Chronic Cough can be associated with paradoxical vocal fold movement (PVFM). These conditions have traditionally been considered separate entities; however, there is emerging evidence for an underlying relationship between them due to the

similarities in associated medical conditions, voice symptoms and psychological issues (Altman et al., 2002; Andrianopoulos, Gallivan, & Gallivan, 2000; Morrison, Rammage, & Emami, 1999; Vertigan et al., 2006a). Milgrom, Corsello, Freedman, Blager, and Wood (1990) found that approximately 50% of individuals with CC demonstrated an abnormal pattern of vocal fold movement during respiration, which is similar to the characteristic pattern of PVFM. This pattern involves involuntary vocal fold adduction during inspiration (Milgrom et al., 1990), attenuation of the inspiratory flow volume curve, and a perception of breathing difficulty (Brugman & Newman, 1993). Similarly, Ryan and Gibson (2006) and Vertigan (2007) found that approximately half the participants with CC had evidence of PVFM following hypertonic saline challenge. Blager (2000) hypothesized that cough is a protective mechanism that relieves glottal constriction that occurs during PVFM episodes. This evidence suggests that a potential for coexisting PVFM could be considered in individuals presenting with CC and that further investigation using fiberoptic nasendoscopy or spirometry with provocation testing would help delineate whether the CC was occurring in isolation or in combination with PVFM.

Voice Disorders

Individuals with CC might present with coexisting voice problems, although there is debate regarding the significance of voice problems in this population. Vertigan, Theodoros, Winkworth, and Gibson (in press-b) reported clinically significant ratings of impaired vocal quality in 40% of individuals with CC, whereas Sandage and Schroth (2005) reported that voice problems were a less significant issue in this population. In most cases, voice problems are thought to be a result of the CC as the voice improves following behavioral management of the cough (Vertigan, Theodoros, Winkworth, & Gibson, in press-a). It is suggested that CC and voice disorders such as muscle tension dysphonia are separate conditions despite similarity in factors associated with their pathogenesis such as GER, upper respiratory tract infection, psychological processes, and extrathoracic airway hyperresponsiveness.

Research regarding triggers to the cough provides further insight into vocal function in individuals with CC. Talking is one of the most frequently identified triggers in individuals with CC (Vertigan et al., 2007). Morice et al. (Morice et al., 2004) suggested that talking and laughing might decrease lower esophageal sphincter tone and subsequently lead to coughing. It has been hypothesized that vocal fold adduction during phonation stimulates pressure receptors in the larynx and results in coughing (Vertigan et al., 2007).

Psychological Issues

There is conflicting information regarding psychological issues in individuals with CC. In the past, CC refractory to medical treatment was considered psychogenic (Irwin et al., 1998). However there is now emerging evidence that psychological issues might not be causal to the CC. Failure to respond to medical treatment does not necessarily prove that a psychiatric disorder exists. Previous research (Vertigan et al., 2007) found that although anxiety and depression scores on the Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983) were higher in individuals with CC than in healthy controls, the majority of individuals with CC had normal ratings.

Although CC can be associated with higher levels of anxiety and depression, a causal relationship between the two conditions has not been defined. Respiratory disorders can also result in psychological problems (Chung, 2003b). Psychiatric dis-

orders in CC could be regarded as amplifiers that exacerbate and perpetuate symptoms and impede recovery rather than as causes of symptoms (Barsky & Borus, 1999). It is argued therefore that the coexistence of psychiatric disorders and CC does not necessarily indicate causality, and previous history of a psychiatric disorder or a stressful social situation might not necessarily contribute to the pathogenesis of CC.

There is limited diagnostic information relating to psychogenic cough in the literature. The criteria for diagnosing psychogenic cough in adults has been based on two subjects with refractory cough who had been given a diagnosis of psychogenic cough (Mastrovich & Greenberger, 2002). The first patient had failed medical treatment but had not attended a psychiatric examination. The second patient was reported to suffer from depression yet refused a psychiatric evaluation. This patient's cough did, however, improve once she became more satisfied with life circumstances. The absence of psychiatric assessment raises questions about the diagnosis of underlying psychopathology in these cases.

Globus Pharyngeus and Dysphagia

Patients with CC may complain of upper airway symptoms such as a sensation in their throat, globus, and difficulty swallowing. Morrison et al. (1999) classified these symptoms as manifestations of the irritable larynx syndrome that encompasses CC, PVFM, globus, and dysphonia. Previous research has confirmed that globus and swallowing symptoms occur significantly more frequently in CC than in the healthy population (Vertigan et al., 2007) and that these symptoms respond to specific treatment programs for CC (Vertigan et al., 2006b). It therefore could be argued that globus and dysphagia symptoms are part of the symptom profile of CC.

SPEECH PATHOLOGY MANAGEMENT OF CHRONIC COUGH

There are a number of reasons why speech pathology intervention might be appropriate for individuals with CC. In discussing the related condition of PVFM, Mathers-Schmidt (2001) argued that speech pathology knowledge in the areas of voice, swallowing, and motor speech disorders would prepare clinicians to detect abnormalities in laryngeal and respiratory functions and to teach la-

ryngeal and respiratory control techniques. The same argument could easily be applied to the management of CC.

Speech pathology management of CC employs techniques adapted from those used to treat hyperfunctional voice disorders (Altman, Mirza, Ruiz, & Sataloff, 2000; Blager et al., 1988) and involves teaching patients over a number of sessions to control a function previously considered automatic and outside of their control. The aim of speech pathology management of CC is to teach individuals to identify the precipitating sensation for the cough, to voluntarily suppress their cough, to reduce laryngeal irritation that could exacerbate the cough, and to optimize vocal behavior. Speech pathology intervention for CC addresses symptoms rather than the underlying cause. Similarly, in some pharmaceutical management of cough, antitussives provide symptomatic relief for cough symptoms without addressing the underlying cause (Altman et al., 2002). Speech pathology management could be a viable alternative to symptomatic pharmaceutical options and have the potential for longer term effects.

A review of the literature has indicated a degree of consistency between studies in the description of the treatment programs used by speech pathologists in the management of CC and have demonstrated positive outcomes (Blager et al., 1988; Gay et al., 1987; Murry et al., 2004; Vertigan, 2001; Vertigan et al., 2006b). One of the first reports of speech pathology management for CC was by Blager et al. (1988) who applied techniques such as diaphragmatic breathing, reducing tension in the laryngeal region, and psychotherapy in four patients. Two patients were fully compliant with all aspects of the program while a further two completed the psychotherapy component without the full speech pathology component. Following treatment, all patients experienced a reduction in the severity of their coughing attacks and were able to cease taking corticosteroid medication. However, the frequency of coughing remained unchanged in the two patients who had not completed the entire speech pathology program.

Gay et al. (1987) reported a similar treatment program involving speech therapy, relaxation, and psychotherapy in four patients. A critical component of this treatment program was the redefinition of the illness to encourage patients to relinquish the notion of an organic cause. Those patients who accepted their diagnosis demonstrated reduced hospitalizations, reduced steroid use, and improvements in socialization and happiness.

One patient however did not accept the CC diagnosis and required rehospitalization for the cough and respiratory symptoms.

Another report (Vertigan, 2001) described a treatment program for behavioral management of 12 patients with CC. The program involved behavior modification, cognitive adjustment, vocal hygiene, and promoting efficiency of voicing. Results showed improvement in the ability of most patients to control their cough. However, there was a large attrition rate with only half the patients completing the program. Furthermore, no comparison groups were used and detailed information of posttreatment assessment was unavailable.

A recent study (Murry et al., 2004) described a case series of five patients with a combination of laryngopharyngeal reflux, CC, and PVFM using a retrospective chart review. Patients underwent a trial of respiratory training consisting of breathing exercises focusing on breathing with minimal expiratory force and with a regular rhythm. The authors described similarities in speech pathology treatment for CC and PVFM. Mean cough severity decreased in all patients at the conclusion of therapy. This study provided a significant contribution to the evidence base on behavioral management of CC and PVFM, particularly for individuals presenting with both conditions. It also demonstrated that maximal medical treatment for reflux might improve reflux symptoms without having a significant impact on the cough.

A study reported by Vertigan et al. (2006b) designed to address some of the methodological limitations of previous studies involved a prospective, randomized, single blind placebo-controlled trial of speech pathology intervention for CC. Eighty-seven individuals with CC were randomly assigned to receive specifically designed speech pathology intervention for their CC or an equivalent course of healthy lifestyle education. Participants in both groups attended four intervention sessions with a qualified speech pathologist. The results indicated a significantly greater improvement in clinical outcome and symptom ratings in the treatment versus the placebo group.

Psychological Approaches to Chronic Cough

Reports of psychological approaches to CC are generally limited to case studies (Alexander, 1973; Bye, 2000; Cohlman & Stone, 1984; Creer, Chai, & Hoffman, 1977; Fulcher & Cellucci, 1997) and are typically used when the cough is considered

psychogenic. There has been no uniformity to the psychological approaches used to treat CC. Examples of psychological approaches include aversion therapy such as mild electric shock (Alexander, 1973; Creer et al., 1977) and suggestion therapy whereby the clinician informed the patient that the cough was a habit unrelated to any physical illness and that it must cease (Lokshin, Lindgren, Weinberger, & Koviach, 1991; Weinberg, 1980). A novel extrapolation of suggestion therapy involved wrapping a sheet tightly around the torso for 24–48 hours with the suggestion that this would stabilize the chest and eliminate coughing (Cohlan & Stone, 1984). Other techniques have included biofeedback of air flow (Bye, 2000) and desensitization to airflow by breathing through a straw (Fulcher & Cellucci, 1997). These latter authors considered that breathing acted as a trigger to cough, that the technique altered airflow volume, eliminated the unpleasant sensation that had negatively reinforced the cough, and modified the patient's belief that he could not control the cough.

The outcomes of most psychological approaches to CC have been positive. One study of aversion therapy reported total suppression of the cough after treatment (Creer et al., 1977); however, another reported a sharp increase in the cough and hostility from the patient requiring subsequent modification to the program (Alexander, 1973).

Some aspects of psychological approaches to CC are consistent with speech pathology treatment. It is likely that speech pathology treatment contains an element of suggestion therapy when patients are given information about the expected outcome. Gavin, Wamboldt, Brugman, Roesler, and Wamboldt (1998) reported that approaches such as biofeedback, relaxation, and hypnosis can be effective but are less specific and efficient than speech pathology approaches. Further, speech pathology approaches may also serve to control anxiety through focused breath control (Gavin et al., 1998).

There are several limitations to studies of psychological approaches to CC. The validity of the psychogenic diagnosis should be questioned, as many studies failed to exclude medical conditions that are known to be associated with cough (Vertigan et al., 2006a). One case study diagnosed a patient with psychogenic cough because he coughed in response to saline, which was considered a benign substance (Alexander, 1973). However, saline is known to trigger a cough in people with extrathoracic hyperresponsiveness and cough (Bucca et al., 1991), and the possibility of extrathoracic hyperre-

sponsiveness in this patient had not been satisfactorily excluded. There is considerable controversy surrounding the use of aversive procedures when nonaversive procedures have been empirically validated as viable alternatives (Pierce & Watson, 1998). The rationale for the results of psychological approaches to CC is limited (Pierce & Watson, 1998). Finally, these studies included confounding variables (Pierce & Watson, 1998), did not use control groups, and provided limited data on pre- and posttreatment assessments.

PROTOCOL FOR SPEECH PATHOLOGY MANAGEMENT OF CHRONIC COUGH

The following protocol for speech pathology management of CC encompasses referral, assessment, treatment, and follow-up. The efficacy of this program has been demonstrated and recently reported in the literature (Vertigan et al., 2006b).

Referral

Persons with CC should receive a comprehensive medical evaluation before being referred for speech pathology management (Gay et al., 1987). There is no evidence to support speech pathology treatment of CC prior to medical intervention. It is essential that speech pathology treatment be coordinated with medical management rather than operate in isolation or competition and should be conceptualized as an adjunct rather than an alternative to medical intervention. In many cases, medical intervention such as medication for GER or asthma might continue for the duration of the speech pathology treatment. Sandage and Schroth (2005) suggested that speech pathology intervention can be beneficial even in the presence of comorbid conditions.

Defining what constitutes appropriate medical management for CC is complex. It is argued that medical treatment according to the ADP should be a minimum standard. However the interpretation of this standard is controversial particularly in the management of GER. Referral policies for CC are particularly important for speech pathologists working in settings that allow patients to self-refer. Indicators for referral of individuals with CC to speech pathologists are suggested in Table 2. Patients with items listed as exclusion criteria should be referred for additional investigation and treatment prior to undergoing speech pathology intervention. It is recommended that a referral for

TABLE 2. Criteria for referral for speech pathology management of chronic persistent cough.

Criteria	Indicator
Inclusion criteria	Chronic cough Cough persists for 2 months following medical treatment Cough is problematic for the patient
Indicators for referral	Inspiratory dyspnea or audible inspiration Cough persisting following minimum of 1 month trial of proton pump inhibitor medication Attenuation of inspiratory limb of flow volume loop during spirometry or provocation challenge Glottal constriction directly observed during nasendoscopy Dysphonia Cough persisting despite medical treatment for asthma and postnasal drip syndrome
Exclusion criteria	Patient not reviewed by a respiratory physician Spirometry not conducted Trial of withdrawal of ACE inhibitor not conducted Untreated gastroesophageal reflux Untreated asthma Asthma not reviewed in last 2 years Untreated postnasal drip syndrome Current upperrespiratory tract infection

speech pathology management of CC not be made simply because it has been requested by the patient but rather once he or she meets the specific criteria for referral.

It is important that patients with CC understand the rationale for their referral to speech pathology, otherwise compliance and motivation might be compromised. Some patients are mystified regarding the reason for a referral to speech pathology (Russell, 1991) as they do not have a problem with their speech. Some patients may have received a clear explanation of the rationale for their referral, whereas others require further explanation and reassurance that speech pathology is a specific treatment for their disorder, otherwise they may feel their condition has not been appropriately addressed and continue to seek further medications (Gay et al., 1987). Barsky and Borus (1999) warned about overly aggressive investigations, which can foster the sick role and lead patients to expect a definitive medical explanation.

Case History Interview

A protocol for collecting the case history information is recorded in the appendix at the end of this article. The case history encompasses the patient's

description of the problem; relevant medical history, particularly information pertaining to associated causes of the cough such as GER; postnasal drip syndrome; asthma; ACE inhibitor use and smoking; and current medications. Previous medical treatment for the cough including the impact of these treatments on the underlying condition and on the cough, should be recorded. The Reflux Symptom Index can provide useful information regarding symptoms of laryngopharyngeal reflux (Belafsky, Postma, & Koufman, 2002). This index monitors change in symptoms of laryngopharyngeal reflux following medical treatment. Typical alcohol, caffeine, and water consumption provide important information regarding hydration and the potential for laryngeal irritation.

The case history should include information regarding the onset, duration, and progression of the cough. Some patients have had a CC for many years and find it difficult to recall details surrounding onset. The patient's degree of concern about his or her cough could have implications for motivation in therapy. At one end of the spectrum patients may be extremely concerned and frustrated by their cough, find it has a significant impact on their daily life, and feel helpless at the inability of medical treatments to relieve their symptoms.

At the other end, patients may seek help primarily due to pressure from family members but be relatively unconcerned about their cough.

Information relating to the specific characteristics of the CC can be useful in tailoring treatment programs to individual patients (Vertigan et al., 2005b). A description of the cough characteristics should include (a) description of the cough, (b) pattern of the cough, (c) perceived warning before the cough, (d) presence of deliberate coughing, (e) perception of control over the cough, (f) strategies used to control the cough, (g) effectiveness of the strategies, (h) triggers to the cough, and (i) breathing route.

Psychological Screening

Although psychiatric and psychological issues cannot automatically be assumed in patients with CC, the potential for these factors to occur should be considered in individual cases. Psychological screening tests such as the Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983) can be useful to indicate an individual's current anxiety and depression status. Ascertaining the patient's perception of whether or not she or he feels the symptoms fluctuate according to stress provides further qualitative information and provides an opportunity for patients to reflect on this potentially predisposing or exacerbating factor in their condition. This reflection also engenders ownership for patients to evaluate the role of stress in their condition rather than a professional suggesting that stress may be the cause of symptoms.

Psychological screening tests can be readministered at the conclusion of intervention to monitor change in psychological symptoms. If psychological symptoms improve following resolution of the cough, then anxiety and depression issues could be assumed to be a result rather than a cause of the cough, although it is difficult to discount non-specific therapeutic benefits of speech pathology intervention such as warmth and empathy. For some patients, having someone understand their problem can be therapeutic (Morrison et al., 1999). A significant rating on a psychological screening test or significant issues arising from the case history could suggest that a referral to a mental health professional might be indicated.

Symptom Rating

There is an increased prevalence of respiratory, voice, and upper airway symptoms in individu-

als with CC (Vertigan et al., 2007). Therefore recording symptoms associated with CC provides a comprehensive understanding of the patient's particular symptom profile. Previously reported rating scales for CC (Murry et al., 2004; Vertigan et al., 2007), or visual analogue scales might provide baseline information on the severity of the CC and serve as a useful outcome measure following intervention. Additional investigation of globus and swallowing symptoms in CC might not be indicated but could be considered if they persist following intervention.

Voice Assessment

It is argued that as a minimum a perceptual description of voice quality should be conducted in individuals presenting with CC. More comprehensive assessment of vocal function, including formal perceptual and instrumental measures, should be conducted in individuals who report voice changes or problems, those who present with disordered voice quality during the case history interview, those with a concern about their voice, and professional voice users. Clinical experience has also demonstrated that voice assessment tasks such as vowel prolongation, scale, and glide tasks can trigger coughing in individuals with CC. Formal measures of vocal function could serve as additional outcome measures for those patients presenting with coexisting voice problems. It is essential to determine the patient's level of concern about his or her voice. While voice problems can be severe in some patients with CC, they might be primarily concerned about their cough and relatively unconcerned about their voice.

Other Observations

The patient's habitual pattern of breathing, particularly the presence of shallow clavicular breathing, should be recorded. Excessive neck and shoulder tension may be observed in individuals with coexisting PVFM. Observations regarding coughing during the assessment should include description, pattern, and identifiable triggers. In some cases formal voice assessment tasks might increase episodes of coughing. The patient's attempts to suppress his or her cough and the degree to which the patient is aware of coughing are also important to record. In many cases, however, individuals with CC might cough during the assessment and therefore information relating to the cough might only be evident from the case history. The severity of

the cough and an estimation of the patient's motivation and capacity for behavior change should also be determined.

The condition of CC can be conceptualized as either CC in isolation or CC in combination with related conditions such as PVFM or muscle tension dysphonia. It is worthwhile noting whether in patients with coexisting PVFM, the cough occurs in an apparent attempt to release glottal constriction during respiration (Blager, 2000). The assessment might indicate that speech pathology is not appropriate for that individual or that additional diagnostic information is required before determining eligibility for the treatment. Speech pathologists should feel justified in withholding or delaying intervention in situations where it is not deemed appropriate.

Treatment

The treatment program comprises four components. Clinical experience has demonstrated that it is preferable to commence treatment in the same session as the initial assessment in order to provide immediate assistance to patients and facilitate motivation with the program. It is important to provide reassurance that the program can be modified throughout the course of intervention particularly if difficulties are perceived. It can also be beneficial to reassure patients that therapy will not continue indefinitely if the program does not appear to be successful.

The exact number of treatment sessions should be tailored to the needs of the patient (Murry et al., 2004). The number of treatment schedules reported in recent studies of CC has ranged from two to seven sessions, generally over a 2- to 3-month period (Murry et al., 2004; Sandage & Schroth, 2005; Vertigan et al., 2006b). It is important to be aware of the potential for therapist dependence and that protracted schedules would not appear to be supported by the literature. After the initial assessment, it is more important to focus on controlling and coping with symptoms (Barsky & Borus, 1999) than to dwell on specific details of symptoms in subsequent treatment sessions. Barsky and Borus warned that some people might become engrossed in discovering the cause of their symptoms at the expense of palliative treatment.

Component One: Education

The education component of the treatment program aims to reinforce the rationale and goals

surrounding the behavioral approach to managing CC and seeks to reinforce three concepts. The first concept is that in contrast to acute cough there is no physiological benefit from repeated coughing. Indeed there are negative side effects from repeated coughing, including laryngeal trauma, exacerbation of irritation, and perpetuation of the cycle of coughing. Therefore one goal of treatment is to suppress the cough even in situations where there is a sensation of needing to cough or clear phlegm. Some patients are concerned that they will come to harm from suppressing their cough and need reassurance that inhibiting the cough will not be detrimental.

The second concept relates to the notion of the cough threshold. It is hypothesized that in CC consciously suppressing the cough gradually raises the threshold for cough, desensitizes the cough reflex, and reduces the frequency of coughing. Previous authors have proposed that continuous coughing reduces the cough threshold and sensitizes the cough so that it is triggered by smaller and smaller amounts of stimuli (Blager, 2003; Sandage & Schroth, 2005). Patients with CC have increased cough reflex sensitivity so that their cough is evoked by stimuli that are normally subthreshold for initiating the cough reflex (Kallarik & Udem, 2003). Previous research in healthy volunteers and individuals with upper respiratory tract infections has shown that delaying or inhibiting the cough can raise the threshold for cough (Hutchings, Eccles, Smith, & Jawad, 1993; Smith et al., 2005). Hutchings et al. (1993) claimed that in acute cough, sensory input is summated by the cough center until a threshold is reached that leads to coughing. If the cough is voluntarily inhibited, then the duration of the cough suppression time will be related to the rate at which sensory input is summated in the cough center. Voluntary suppression of cough may change the sensitivity of cough receptors and raise the threshold for cough so that the cough occurs when the afferent input from sensory receptors summates to the new threshold (Hutchings et al., 1993; Lee, Cotterill-Jones, & Eccles, 2002). A case study of aversion therapy for CC found that the patient reported no urge to cough at the conclusion of therapy (Alexander, 1973). Although not suggested by the authors, it is possible that voluntarily suppressing the cough increased the threshold for cough in this individual.

The concept of the cough threshold can be explained to patients graphically (Figure 1) to facilitate understanding of the rationale for treatment. In this figure, stimulation of cough receptors in

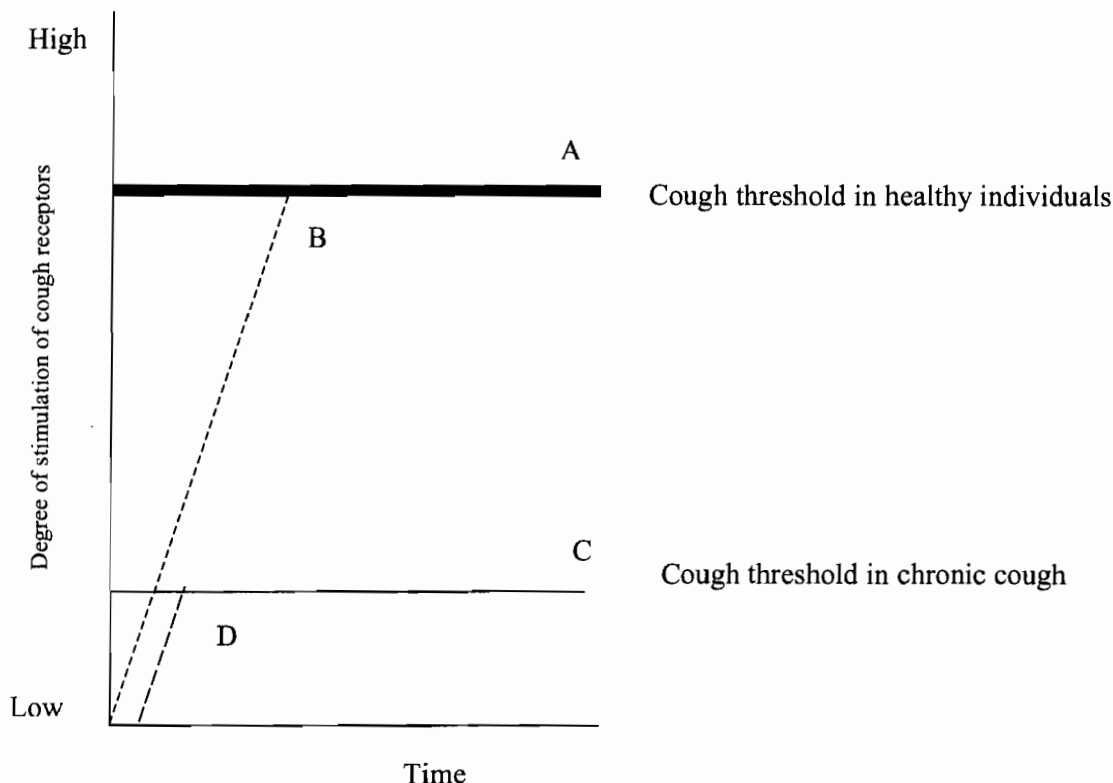


Figure 1. Threshold for cough and cough stimulation in healthy individuals and individuals with CC. *Note.* Stimulation of cough receptors needs to summate to level A in order to trigger a cough in healthy individuals and level C in CC. Speech pathology treatment aims to increase the threshold for cough and reduce the rate of stimulation of cough receptors.

healthy individuals needs to summate to level A in order to trigger a cough but only needs to summate to level C in individuals with CC. Speech pathology treatment aims to raise the threshold for cough by teaching patients strategies to inhibit, suppress, delay, or interrupt their cough and to reduce stimulation of their cough.

The third concept in the education program involves helping patients understand their potential to voluntarily control the cough. The role of voluntary control of CC is an important component of behavioral management (Andrianopoulos et al., 2000; Blager et al., 1988; Gay et al., 1987). Coughing is usually the result of an involuntary reflex response to stimulation of cough receptors in the airways (Farrer, Keenan, & Levy, 2001; Irwin et al., 1998; Philp, 1997). A variety of peripheral receptor sites communicate via the vagus nerve to the cough center in the medulla. Laryngeal and tracheobronchial receptors can be irritated by both chemical and mechanical stimuli (Irwin et al., 1998). The motor outputs from the cough center send motor neurons to the inspiratory and expi-

ratory muscles, larynx, and bronchial tree (Irwin et al., 1998). However, since cough may be voluntarily initiated, postponed, or suppressed (Philp, 1997; Spinney, 2002) there may be afferent input into cough control from higher centers (Irwin et al., 1998; Lee et al., 2002; Spinney, 2002).

The concept of voluntary control needs to be emphasized, as some patients believe that the cough is a reflex that cannot be controlled. The potential for cortical control following speech pathology intervention is outlined in Figure 2, and it demonstrates that although reflexive control of the cough is the predominant mechanism, cortical or voluntary cough control can be enhanced following speech pathology intervention.

Component Two: Strategies to Control the Cough

Once the patient understands the rationale for treatment the next step is to teach specific techniques to control the cough. These techniques require the patient to identify when a cough is about

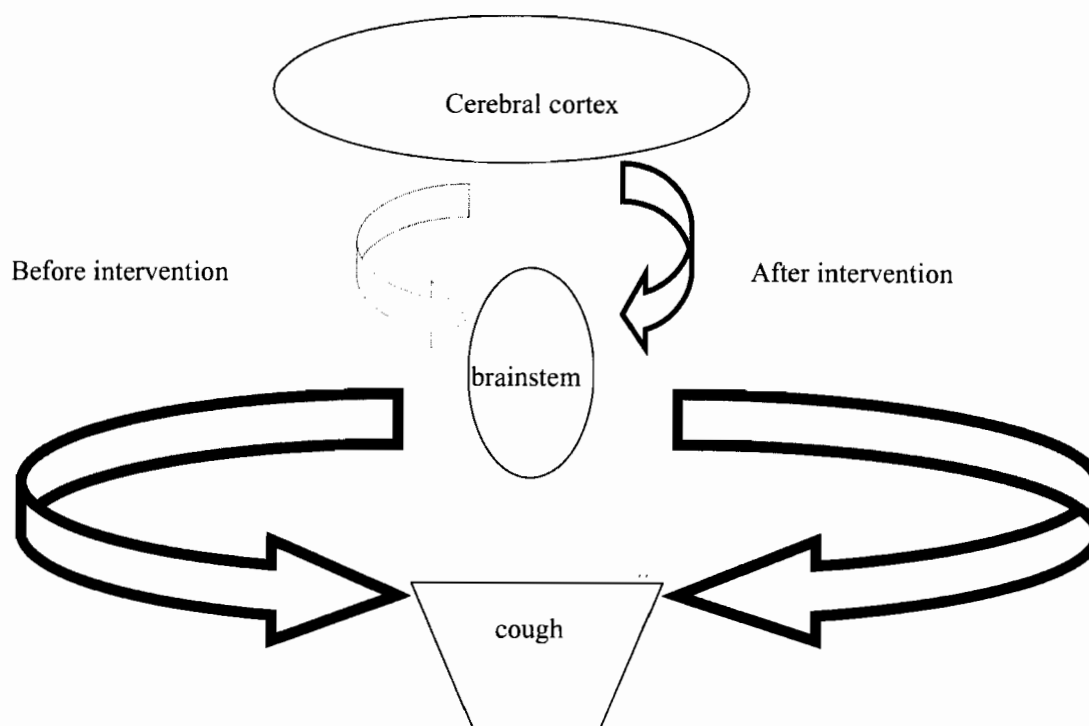


Figure 2. Schematic representation of cortical and reflexive control of cough before and after speech pathology intervention. *Note.* Cough control is a combination of voluntary and reflexive mechanisms therefore there is capacity for voluntary cough control. It is hypothesized that treatment improves voluntary control.

to occur and then implement a strategy to suppress or replace the cough. Techniques can include relaxed throat breathing similar to that used for PVFM (Mathers-Schmidt, 2001), the pursed lip breathing technique (Blager et al., 1988), and substituting the cough or throat clear with a swallow or other distraction techniques. The pursed lip breathing technique involves breathing out through pursed lips in order to maximize expiratory flow through the larynx. Swallowing can interfere with the cough (Eccles, 2003) and can be modified to include an effortful Valsalva swallow utilizing head flexion that is implemented as a dry swallow or with a sip of water. Distracting techniques include drinking water, sucking ice, chewing gum, attempting to delay the cough, and sucking nonmedicated candy to increase the frequency of saliva swallows.

The techniques are initially taught in the clinical setting. Patients may require a hierarchy for controlling their cough starting in the clinical setting, to every day activities, and then into more challenging activities such as in the presence of

known triggers. Some people are able to identify cough triggers easily while for others there is no consistent pattern to triggering stimuli. Once a cough trigger is identified, cough strategies can be employed during short exposures in order to build tolerance to the trigger (Blager, 2003). Avoiding exposure to identified triggers is helpful in the initial stages of therapy, although Barskey and Borus (1999) warned that some patients can be caught in a vicious cycle in which the ineffectiveness of an approach such as avoiding exposure can lead to its intensification rather than its abandonment.

A critical component of the program involves anticipating that a cough is about to occur and implementing the strategy at the first sign of a cough or laryngeal irritation. Some patients may wait until they are certain they are about to cough or wait until the cough is just about to occur before implementing the cough strategy. Some patients may require encouragement to pause in their everyday activity to prevent the cough. Some patients are unable to perceive warning signs to their cough and thus are unable to anticipate a cough. These

patients benefit from maintaining a diary of their cough episodes along with laryngeal dryness and irritation in order to increase their awareness of preceding sensations to the cough. It is hypothesized that some participants have mild laryngeal irritation of which they are unaware, and that if prolonged or exacerbated could trigger coughing.

Clinical experience suggests that some patients are able to suppress their cough easily while others find it takes considerable effort to inhibit their cough and might only be able to delay it for a period of time. Some patients report deliberately coughing in response to laryngeal irritation (Vertigan et al., 2007). These patients require modification to their intervention program to manage their laryngeal sensation, including increasing hydration, minimizing exposure to irritating triggers, increasing swallowing frequency, and education about the potential of coughing and throat clearing to exacerbate irritation (Vertigan et al., 2007).

Component Three: Vocal Hygiene

The vocal hygiene component of the program is designed to reduce the degree and rate of stimulation of the cough receptors and therefore slow the rate at which the threshold for cough is reached (see Figure 1). Vocal hygiene aims to maximize hydration while reducing laryngeal irritation and subsequent stimulation of cough receptors. Specific issues relating to vocal hygiene include avoiding smoking or exposure to passive smoke; minimizing consumption of substances known to have a drying effect on the larynx such as alcohol, caffeine, and medicated cough lozenges; increasing systemic and surface hydration through steam inhalation and increasing the volume and frequency of water intake; and strategies for behavioral management of gastroesophageal reflux. Encouraging nose rather than mouth breathing and increasing ambient humidity have also been recommended (Sandage & Schroth, 2005). It is important to discuss the rationale for vocal hygiene strategies and to provide an opportunity to explore any specific issues surrounding the implementation of the strategies and modification of the strategies to maximize compliance.

Component Four: Psychoeducational Counseling

Patients need to be motivated to control the cough in order to adopt this treatment approach. It is important to validate the patient's concerns about

the cough, acknowledge that they are not malingering, and that their perception of the need to cough is real rather than imagined (Blager, 2003; Sandage & Schroth, 2005). The psychoeducational component of the program addresses some differences between behavioral and medical treatment and aims to facilitate acceptance of a behavioral approach (Vertigan, 2001). In speech pathology treatment, the patient has the ultimate responsibility for controlling symptoms in contrast to medical treatment where medication is largely responsible for symptom control. Patients may be encouraged to internalize control over their cough by viewing the cough as something they do in response to irritating stimuli rather than a phenomenon outside of their control. It is also crucial to assist individuals to set realistic goals, for example, that the aim of treatment is to control rather than totally eliminate the cough. Acknowledgment that treatment is hard work, that there is no easy cure and that results may not be observed immediately, and development of partnership with the patient may assist individuals develop realistic expectations about treatment. Patient compliance in voice therapy is enhanced when they have high self-efficacy, that is they believe they have the potential to do the therapy (Gillespie, 2005). Patients need to understand that they have the capacity to control their cough, and the program should be modified so that the patients have the capacity to comply and manage suggestions. It is also important to note that some patients might improve without complying with all aspects of the program. For example some patients may detest the idea of increasing water intake but increase the intake of other noncaffeinated beverages.

Treatment Considerations

The effectiveness of intervention should be monitored consistently throughout the program. At the commencement of each session it can be helpful to obtain the patient's estimate of their degree of improvement or to rate symptoms on a visual analogue scale. These ratings can suggest whether or not the treatment program is appearing to be successful for individuals. In addition a rating of treatment outcome including symptom rating and a determination of whether or not the treatment was successful should be made at the conclusion of intervention. Clinical observation has shown that most patients reduce the frequency and severity of coughing and perceive better control over their cough at the conclusion of therapy, although they

may still experience some residual coughing. Other patients may experience a dramatic reduction in coughing after the first treatment session.

Previous research has indicated that improvement in voice can occur following successful intervention for the CC (Vertigan et al., 2006b). However, voice problems might persist despite resolution of the cough in some individuals, and specific voice therapy programs might be indicated in these cases. The patient's level of concern regarding her or his voice should be ascertained before commencing additional voice therapy.

Problem Solving. Problem solving is a critical component of the program. Many patients will experience benefit from the program as outlined above; however, others need assistance to problem solve and modify the program. Failure to improve can be due to factors such as lack of compliance, inadequately managed underlying processes for the cough, conflicting advice, coexisting PVFM, poor self-awareness, upper respiratory tract infection, and externalized locus of control. Compliance can be affected by the patient's understanding of the rationale, dislike of the program, feeling overwhelmed by the requirements of the program, lack of belief that the program will work, and receipt of conflicting advice from other individuals. The reasons for reduced compliance need to be explored and validated rather than implying that it is the patient's fault. The requirements of the program may need to be reiterated, rephrased, or modified. For example, a patient who finds it too difficult to attempt to suppress every cough might find it easier to concentrate on suppressing the cough during specific situations or specific time periods.

Some patients may have been given conflicting information by another individual, which compromises their capacity to accept the rationale for the behavioral approach. Individuals with CC might have associated PVFM and benefit from greater emphasis on the relaxed throat breathing technique. Some individuals have poor self-awareness and therefore have difficulty identifying the precipitating sensations of the cough. In cases where individuals have an externalized locus of control, they might require greater emphasis on counseling to reconceptualize cough as something that they need to learn to control. Some patients might need additional assistance to work through a more structured hierarchy of difficulty in suppressing the cough.

The cough can be exacerbated if individuals develop an upper respiratory tract infection during

the course of intervention. It could be argued that cough associated with upper respiratory tract infection is a response to irritation rather than needing to clear the lungs and that it could be voluntarily suppressed. However, to date there is little data to support this assumption, and suggestions regarding cough suppression need to be discussed with each individual's medical practitioner.

Discharge and Follow-Up. Patients can be discharged from speech pathology once they have demonstrated capacity to control the cough. They do not need to have achieved full cough suppression. It is anticipated that the treatment program will have enabled patients to be responsible for the ongoing management of their cough; however, specific procedures need to be tailored for each patient. Some patients may express concern about future reoccurrence of their cough in the presence of upper respiratory tract infection or climactic changes. An action plan for managing the cough if it reemerges could include increasing hydration, particularly if warning signs such as a sore throat or rhinitis signal onset of an upper respiratory tract infection; increasing the frequency of cough suppression strategies; and advice to pay more attention to triggers and warning signs until their cough feels under control. Patients should also be advised to contact their speech pathologist for additional advice and if necessary to access a review appointment.

CONCLUSION

Chronic cough is a frustrating condition for both patient and clinician. Thorough medical evaluation and treatment of associated causes of cough needs to occur before speech pathology intervention is implemented. Speech pathology management should encompass a comprehensive assessment of cough characteristics. The rationale for each component of the treatment program has been outlined. Problem solving is a critical component of the treatment program. It is hoped that this clinical article will assist speech pathologists in the practical application of therapeutic techniques for individuals with CC. It is also argued that even in cases where the cough is truly psychogenic, speech pathology intervention might validate the patient's symptoms and process of recovery. It is argued, however, that speech pathology intervention is a viable treatment option for individuals with CC.

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APPENDIX

Chronic Cough Case History and Assessment Form

Biographical Details

Name: _____

DOB: _____ Record Number: _____

Referring Specialist: _____

Primary Care Physician: _____

Date referred to speech pathology _____ Date of assessment _____

Main referring diagnosis _____

Presenting Problem

Main problem reported by patient: _____

Patient's description of the problem: _____

Patient's belief in the cause of the problem: _____

Medical Information: (please circle appropriate answer)**Smoking:** yes no ceased**ACE inhibitor:** yes no ceased (if ceased, any impact on cough _____?)**Chest radiograph:** yes no Results _____**Reflux symptoms:** yes no

→ If yes, previous treatment for reflux? Type _____

Still taking? _____ Last time reviewed: _____

Effect on underlying condition: _____

Effect on cough: _____

Reflux Symptom Index Score: _____

Asthma: yes no

If yes, how diagnosed? _____

Treatment: type _____ Last time reviewed _____

Effect on underlying condition: _____

Effect on cough: _____

Post nasal drip syndrome: Yes no

If yes, previous treatment for post nasal drip: Type: _____

Duration: _____ Still taking? _____

Effect on underlying condition: _____

Effect on cough: _____

Other treatment for cough: Type: _____

Duration: _____ Still taking? _____

Score on psychological screening test: _____**Obstructive sleep apnoea?** Yes no **Snoring?** Yes no**Other medical history:** _____

Medications: _____

Social history: _____

Hydration/Vocal Hygiene:

Alcohol : Yes no Details: _____

Water intake: _____

Caffeine: _____

Exposure to fumes: _____

Mouth breathing: _____

Cough history: Onset: _____

Duration: _____

Progress: _____

Affected by stress? _____ Affected by voice use? _____

Voice History:

Voice problems: _____

Voice changes: _____

Professional voice user: yes no Typical voice use: yes no

Singing: yes no

ENT review? yes no Cough triggered by talking: yes no

Symptoms:

Breathing problems: (e.g., difficulty inspiring air, shortness of breath on exercise) _____

Upper airway symptoms: (e.g., swallowing problems, globus pharyngeus symptoms, dry mouth)

Cough Description:

Description of cough (e.g. dry, irritated, productive): _____

Where initiated (e.g., throat, chest): _____

Pattern of cough (e.g., continuous/bouts): _____

Warning before cough (e.g., never, sometimes, always) _____

Cough deliberately (e.g., never, sometimes, always) _____

Triggers for cough: _____

Perception of control over cough: _____

Strategies used to control cough: _____

Effectiveness of those strategies: _____
Patient's concern about their cough: _____

Observations to Make During Case History Interview:

Does talking trigger cough?	yes	no
Do voice assessment tasks trigger cough?	yes	no
Habitual breathing pattern?	mouth	nose
Presence of coughing	yes	no
Presence of throat clearing?	yes	no
Attempts to control cough?	yes	no
Audible inhalation?	yes	no

Voice quality _____
