

Interventions for treating functional dysphonia in adults (Review)

Ruotsalainen JH, Sellman J, Lehto L, Jauhiainen M, Verbeek JH



**THE COCHRANE
COLLABORATION®**

This is a reprint of a Cochrane review, prepared and maintained by The Cochrane Collaboration and published in *The Cochrane Library* 2007, Issue 3

<http://www.thecochranelibrary.com>



TABLE OF CONTENTS

ABSTRACT	1
PLAIN LANGUAGE SUMMARY	2
BACKGROUND	2
OBJECTIVES	3
CRITERIA FOR CONSIDERING STUDIES FOR THIS REVIEW	3
SEARCH METHODS FOR IDENTIFICATION OF STUDIES	4
METHODS OF THE REVIEW	5
DESCRIPTION OF STUDIES	6
METHODOLOGICAL QUALITY	7
RESULTS	8
DISCUSSION	9
AUTHORS' CONCLUSIONS	10
POTENTIAL CONFLICT OF INTEREST	10
ACKNOWLEDGEMENTS	10
SOURCES OF SUPPORT	11
REFERENCES	11
TABLES	14
Characteristics of included studies	14
Characteristics of excluded studies	16
ADDITIONAL TABLES	18
Table 01. Controlled (Non-randomised) Trials	18
Table 02. Description of rating scales used	19
Table 03. Assessment of study quality	19
Table 04. Search strategies	20
ANALYSES	21
Comparison 01. Any intervention vs. no intervention	21
Comparison 02. Combined direct and indirect voice therapy vs. TFL-assisted treatment	21
COVER SHEET	21
GRAPHS AND OTHER TABLES	22
Analysis 01.01. Comparison 01 Any intervention vs. no intervention, Outcome 01 Primary (subjective) outcomes	22
Analysis 01.02. Comparison 01 Any intervention vs. no intervention, Outcome 02 Secondary (objective) outcomes	23
Analysis 02.01. Comparison 02 Combined direct and indirect voice therapy vs. TFL-assisted treatment, Outcome 01 Vocal Performance Questionnaire	23

Interventions for treating functional dysphonia in adults (Review)

Ruotsalainen JH, Sellman J, Lehto L, Jauhiainen M, Verbeek JH

Status: *New*

This record should be cited as:

Ruotsalainen JH, Sellman J, Lehto L, Jauhiainen M, Verbeek JH. Interventions for treating functional dysphonia in adults. *Cochrane Database of Systematic Reviews* 2007, Issue 3. Art. No.: CD006373. DOI: 10.1002/14651858.CD006373.pub2.

This version first published online: 18 July 2007 in Issue 3, 2007.

Date of most recent substantive amendment: 22 May 2007

ABSTRACT

Background

Poor voice quality due to functional dysphonia can lead to a reduced quality of life. In occupations where voice use is substantial it can lead to a loss of employment.

Objectives

To evaluate the effectiveness of interventions to treat functional dysphonia in adults.

Search strategy

We searched MEDLINE (PubMed, 1950 to 2006), EMBASE (1974 to 2006), CENTRAL (*The Cochrane Library*, Issue 2 2006), CINAHL (1983 to 2006), PsychINFO (1967 to 2006), Science Citation Index (1986 to 2006) and the Occupational Health databases OSH-ROM (to 2006). The date of the last search was 5th April 2006.

Selection criteria

Randomised controlled trials (RCTs) of interventions evaluating the effectiveness of treatments targeted at adults with functional dysphonia. For work-directed interventions interrupted time series and prospective cohort studies were also eligible.

Data collection and analysis

Two authors independently extracted data and assessed trial quality. Meta-analysis was performed where appropriate.

Main results

We identified six randomised controlled trials including a total of 163 participants in intervention groups and 141 controls. One trial was high quality. Interventions were grouped into 1) Direct voice therapy 2) Indirect voice therapy 3) Combination of direct and indirect voice therapy and 4) Other treatments: pharmacological treatment and vocal hygiene instructions given by phoniatriest.

No studies were found evaluating direct voice therapy on its own. One study did not show indirect voice therapy on its own to be effective when compared to no intervention. There is evidence from three studies for the effectiveness of a combination of direct and indirect voice therapy on self-reported vocal functioning (SMD -1.07; 95% CI -1.94 to -0.19), on observer-rated vocal functioning (WMD -13.00; 95% CI -17.92 to -8.08) and on instrumental assessment of vocal functioning (WMD -1.20; 95% CI -2.37 to -0.03) when compared to no intervention. The results of one study also show that the remedial effect remains significant for at least 14 weeks on self-reported vocal functioning (SMD -0.51; 95% CI -0.87 to -0.14) and on observer-rated vocal functioning (Buffalo Voice Profile) (WMD -0.80; 95% CI -1.14 to -0.46). There is also limited evidence from one study that the number of symptoms may remain lower for a year. The combined therapy with biofeedback was not shown to be more effective than combined therapy alone in one study nor was pharmacological treatment found to be more effective than vocal hygiene instructions given by phoniatriest in one study. Publication bias may have influenced the results.

Authors' conclusions

Evidence is available for the effectiveness of comprehensive voice therapy comprising both direct and indirect therapy elements. Effects are similar in patients and in teachers and student teachers screened for voice problems. Larger and methodologically better studies are needed with outcome measures that match treatment aims.

PLAIN LANGUAGE SUMMARY

Interventions for treating functional dysphonia in adults

Functional dysphonia is characterised by an abnormal quality of voice in the absence of an identifiable lesion. People in occupations where voice use is central, like teachers, are more at risk of developing functional dysphonia. The causes of voice disorders are still being debated. There is also no consensus on the best method of evaluating voice, although many consider auditory voice quality assessment as a gold standard measure. Because functional dysphonia is a non-organic voice disorder there is no indication for surgical or medical interventions, and it is treated with behavioural (i.e. voice) therapy. Voice therapy usually consists of a combination of direct and indirect treatment techniques. Direct techniques focus on the underlying physiological changes needed to improve an individual's technique in using the vocal system whereas indirect techniques concentrate on contributory and maintenance aspects of the voice disorder (such as lack of knowledge).

We conducted a systematic search of the literature on treating functional dysphonia in adults. We then appraised the quality of the studies found and combined their results.

A combination of direct and indirect voice therapy is effective in improving vocal functioning when compared to no intervention. The achieved results may still be apparent after a year.

Most of the studies are small and of low methodological quality and further research is warranted.

BACKGROUND

Voice disorders are generally characterised by abnormalities in pitch, loudness and/or quality of the voice that can limit the effectiveness of oral communication (Ramig 1998). Recent definitions of a disordered voice stress the ability of the voice to fulfil the speaker's social and occupational requirements (Aronson 1985; Sataloff 2000; Stemple 1995). Due to the difficulties of classifying voice disorders in a systematic way, there is no universally accepted classification system for voice problems (Oates 2004). Traditionally, two major classes of voice disorder have been identified: organic and functional (Fawcus 1986; Oates 2004; Titze 1994).

Functional disorders are characterised by an abnormal quality of voice in the absence of an identifiable lesion. Some clinicians label them as idiopathic, indicating that there is no known cause, while others view them as resulting from the individual's improper use of his or her voice (Titze 1994). The improper use of voice (also known as vocal misuse) refers to functional voicing behaviours (e.g. excessive shouting or loud talking) and/or functional misuse of vocal components (respiration, phonation, resonance, pitch, loudness and rate) that can contribute to the development of laryngeal pathologies (Stemple 1995). When the classification into functional versus organic emphasises the aetiology of the problem (vocal strain or excessive muscular tension), minor tissue changes

such as vocal-fold thickening and vocal nodules are often considered functional (Boone 1987) or behavioural (Fawcus 1986). Therefore, in a strict sense dichotomous classification is undeniably problematic and overly simplistic. In this review we define functional dysphonia as an impaired voice sound and/or reduced vocal capacity (Roy 2003; Seifert 2005) with a possible concomitant diagnosis of minor pathologies of vocal fold cover (nodules, polyps, oedema) that are direct results of either vocal misuse or result from trauma caused to vocal fold tissues by phonatory behaviour.

The prevalence of voice disorders in the general adult population has been suggested to be between 3% and 9% in the USA and at about 4% in Australia (Verdolini 2001). In the UK up to 40,000 patients with dysphonia are referred to voice therapy every year (Wilson 1995). Professional voice users such as teachers and singers are at significantly higher risk of developing a voice disorder compared to the general population (Russell 1998; Smith 1997). It has been estimated that at least in developed countries, a well functioning voice is an essential tool for a third of the entire adult working population (Vilkman 2004). In Poland, occupational voice problems ranked highest among all occupational diseases in 2004 (Szeszenia-D. 2005). In a group of 1262 voice patients, the prevalence of vocal pathologies that could be considered as functional dysphonia (no visible pathology) or as being

direct results of traumatising phonatory behaviour (vocal nodules, oedema, polyps) was 57.6% (Herrington-Hall 1988).

The voice is a multidimensional function that, like physical strength, cannot be measured with any one single scale or test (Hirano 1989; Hartl 2005). Measures of voice have therefore been developed to cover widely different perspectives including, for example: aerodynamic, visual and auditory perceptual, physiological and acoustic measurements (Carding 2000). To increase comparability of the results of individual studies, it has been suggested that all studies of vocal treatment effectiveness should perform an extensive battery of tests (Dejonckere 2001). On the other hand, in order to ensure that the results are clinically relevant it has been suggested that the outcome measures should be matched to treatment goals and to efficacy criteria (Carding 2000). For some time now, the patient's own views regarding judgements of the benefits of treatment have been acknowledged as also being important (Carding 2000; Enderby 1995). A number of patient self-report questionnaires, such as the Voice Handicap Index (Jacobson 1999), the Voice-Related Quality of Life (Hogikyan 1999), the Vocal Performance Questionnaire (Carding 1992) and the Voice Activity and Participation Profile (Ma 2001) have been developed to measure the subjective impact of voice problems.

In this review we chose self-reported measures of voice handicap, voice symptoms and voice-related quality of life as primary indicators of treatment effectiveness. This is because of the variation between individuals as to how a particular voice disturbance can be perceived to affect their communication or ability to fulfil social and occupational requirements. All other measures of vocal or laryngeal performance are considered as secondary outcomes, along with measures of sickness absence and return to work.

When it comes to the treatment of functional dysphonia, most experts agree that surgical or medical interventions are not indicated (Carding 1999). Voice therapy is considered effective for the treatment of voice disorders caused by vocal misuse (Stemple 1995). Colton 2006 states that: "In general, the goal of voice therapy is to restore the best voice possible, a voice that will be functional for purposes of employment and general communication". There are numerous different therapy techniques available for the treatment of patients with dysphonia (Carding 1999; Carding 2000). These techniques fall into two main categories:

- 1) Indirect treatment techniques that concentrate on psychosocial aspects such as patient education (Aronson 1985), auditory training (Boone 1983; Fawcus 1986) and vocal hygiene programmes (Wilson 1987);
- 2) Direct treatment techniques that concentrate on mechanical or physical aspects such as the yawn-sigh method (Boone 1993), establishing optimal pitch (Boone 1983) and laryngeal manipulation (Roy 1993).

Studies of the effectiveness of interventions for preventing the onset or relapse of a voice disorder have also been conducted, and

since such measures are taken in the absence of a diagnosed voice disorder they will be dealt with in a separate review. In this review we proposed to establish whether interventions aimed at treating adult patients diagnosed with functional (non-organic) dysphonia are effective when compared to no intervention or to alternative interventions.

OBJECTIVES

- 1) To assess the effectiveness of interventions for treating functional (non-organic) dysphonia compared to no intervention or an alternative intervention.
- 2) To categorise interventions aimed at treating patients diagnosed with functional (non-organic) dysphonia.

CRITERIA FOR CONSIDERING STUDIES FOR THIS REVIEW

Types of studies

All randomised controlled studies or cluster-randomised trials evaluating the effectiveness of treatments targeted at individuals with functional dysphonia. For environmental or work-related treatment interventions, it is much more difficult to randomise when the intervention is applied at the group level. For this type of intervention we also considered for inclusion prospective cohort studies (otherwise known as controlled clinical trials, controlled before-after studies or quasi-experimental studies).

Types of participants

We included studies in which the participants were adults (16 or over) who had been diagnosed as having functional / non-organic dysphonia, which means that they are experiencing one of the following two symptoms:

- 1) an impaired voice sound;
- 2) reduced vocal capacity.

The voice changes throughout life. In childhood the morphology of vocal fold tissues keeps changing and during puberty the larynx grows (Titze 1994). The three connective tissue layers of the lamina propria, despite being apparent already during puberty, continue to become more differentiated until the age of 16 or 17 (Colton 2006). In advanced age some age-related changes (e.g. ossification, atrophy, dystrophy and oedema) affect phonation (Jasper 2000). However, it is the physiological rather than the chronological age that has a strong impact on how well the larynx functions in phonation (Titze 1994). In this study we consider patients older than 16 years as adults. For practical reasons, we also included studies in which a minority of participants (less than 50%) may have been diagnosed with minor tissue changes of vocal fold cover (nodules, polyps, oedema) that are regarded as a result of vocal misuse.

We excluded studies in which any of the participants had been diagnosed as having any of the following:

- a voice disorder associated with local nervous system involvement (e.g. spasmodic dysphonia, essential laryngeal tremor, vocal fold paralysis);
- neurological disorders (e.g. Parkinson's, Alzheimer's, ALS, Tourette's, essential tremor, paralysis);
- organic disease or trauma (e.g. keratosis, contact ulcers, papillomas, laryngeal granulomas and inhalation, thermal etc. traumas);
- the paediatric (e.g. with congenital anomalies) or the geriatric voice;
- carcinoma or other tumours;
- gastro-oesophageal reflux disease.

We also excluded studies in which participants had been diagnosed with a hearing impairment which may affect auditory discrimination.

Types of intervention

We included studies with any intervention aiming to treat patients diagnosed with functional (non-organic) dysphonia. We categorised interventions as:

- 1) Direct voice therapy meaning that the therapy is applied directly to the voice production apparatus;
- 2) Indirect voice therapy meaning therapy that is applied to other mental or bodily structures or functions that influence voice production;
- 3) Combination of direct and indirect voice therapy;
- 4) Other treatments.

We compared interventions with no intervention and, when possible, with alternative interventions.

Types of outcome measures

As primary outcomes we included patient-reported measures of voice handicap, voice symptoms or voice-related quality of life. There are four validated instruments for these measurements that can be used with functional dysphonia patients: Voice-Related Quality of Life (Hogikyan 1999), Voice Activity and Participation Profile (Ma 2001), Voice Symptom Scale (Deary 2003) and the Voice Handicap Index (Jacobson 1999).

As secondary outcomes we included all other measurement techniques for establishing the state of vocal or laryngeal performance including:

1. Instrumental measurements:
 - Aerodynamic measurements
 - Acoustic/electroglottographic measurements (e.g. phonetogram, perturbation measures)

- Laryngeal image analysis (e.g. stroboscopic rating)
2. Observer ratings:
 - Perceptual acoustic analysis (e.g. GRBAS)
 3. Combined measures:
 - Multidimensional measure (e.g. Dysphonia Severity Index)

We were also going to include studies measuring sickness absence or return to work but no studies were found using these outcomes.

SEARCH METHODS FOR IDENTIFICATION OF STUDIES

See: Cochrane Ear, Nose and Throat Disorders Group methods used in reviews.

We searched the literature for evaluation studies of interventions for functional voice disorders without restrictions on language or publication. Systematic search strategies were developed together with the Cochrane ENT Trials Search Co-ordinator and the Cochrane Occupational Health Field Information Specialist.

We searched MEDLINE (PubMed, 1950 to 2006/March), EMBASE (embase.com, 1974 to 2006/March), CENTRAL (*The Cochrane Library*, Issue 2 2006), CINAHL (OVID, 1983 to 2006/March), PsychINFO (webSPIRS, 1967 to 2006/February), Science Citation Index (ISI Web of Science, Thomson, 1986 to 2006/March) and the Occupational Health databases OSH-ROM (webSPIRS, to 2006/February). The search string for randomised controlled trials is based on Robinson 2002 and the string for non-randomised studies on Verbeek 2005. Since the opportunities for naming and classifying voice disorders and their various treatments are so abundant, the searches were developed with the aim of maximum sensitivity at the expense of specificity. The date of the last search was 5th April 2006.

Search strategy for CENTRAL

#1 dysphoni* (in Title, Abstract, Keywords) OR hoarseness (in Title, Abstract, Keywords) OR phonastheni* OR trachyphoni* OR functional voice disorder* OR psychogenic voice disorder* OR ventricular phonation OR conversion voice disorder* OR functional aphonia OR conversion aphonia OR conversion dysphonia OR phonation break OR functional falsetto OR mutational falsetto OR puberphonia OR juvenile voice OR laryngeal myasthenia
#2 (voice OR vocal OR phonation) NEAR (problem* OR symptom* OR complaints OR hygiene OR disorder* OR disease* OR disturbance* OR tremor* OR impair* OR handicap* OR tension* OR strain* OR abuse* OR fatigue* OR misuse* OR reduct*)
#3 #1 OR #2

Search strategies for MEDLINE and EMBASE are shown in Table 04.

References from articles were also carefully reviewed. Authors of studies and other experts in the field were contacted for advice on further studies.

METHODS OF THE REVIEW

Selection of trials

After employing the search strategies outlined above, two authors (JR and JS) undertook study selection. Both authors independently assessed whether the studies thus found met the inclusion criteria. A third author (LL) resolved any disagreements. We sought to obtain further information from the authors when a paper was found to contain insufficient information for reaching a decision on eligibility.

Data extraction and management

Two authors (JR and JS) independently extracted data from each of the included trials regarding the country where the study was conducted, the type of study design used, characteristics of the study participants (as per study inclusion criteria) and types of interventions and outcomes. Results data (means and standard deviations) were also extracted for the purpose of meta-analysis. Where possible, we sought missing data from authors. A third author (LL) resolved any disagreements.

Quality assessment

For this review, it was clear that allocation concealment could not be an issue since the nature of treatments for voice disorders renders it impossible for the patients to be unaware of whether or not they are receiving active treatment. We nonetheless assessed whether allocation was concealed for those assessing the outcome, when it came to secondary observer-rated outcomes. Two authors (JR and JS) independently assessed trial quality using the quality criteria mentioned in the Cochrane Handbook for the Systematic Review of Interventions. This consisted of an appraisal of the studies in terms of their randomisation, allocation concealment and blinding procedures as well as attrition suffered. See Table 03 for a listing of the judgements that we made in terms of these four criteria. Studies were rated as high quality if they were found adequate in terms of all four quality criteria (or three in cases where blinding was not an issue). For the appraisal of cohort studies, we were going to use a validated instrument (Slim 2003). No cohort studies were however included in this review. Disagreements were settled through discussion.

Measures of treatment effect

The results of each trial were plotted as means and standard deviations (SD) for continuous outcomes. Standardised mean differences (SMD) were used for pooling outcome data from different instruments deemed similar enough for comparison.

Dealing with missing data

Where necessary, we sought missing statistics data (means and standard deviations) from authors. Since all studies had outcomes

using continuous data, we were unable to conduct an intention-to-treat analysis. We could not utilise standard approaches such as last observation carried forward or imputing baseline outcomes since we did not have access to raw patient data. Therefore all results were based on available case analysis.

Assessment of heterogeneity

We tested for statistical heterogeneity by means of the I^2 in the meta-analysis graphs. The I^2 statistic describes the percentage of total variation across trials that is attributable to heterogeneity rather than chance. I^2 values of 25%, 50% and 75% correspond to low, moderate and high between-trial heterogeneity. When studies were statistically heterogeneous, a random-effects model was used; otherwise a fixed-effect model was used. All estimates included a 95% confidence interval (95% CI).

Data analysis

For interventions directed at individuals, we used only randomised controlled trials to draw conclusions. For work- or environment-directed interventions that are applied at the group level we were going to include also prospective cohort studies but none were identified that met our inclusion criteria.

The decision to pool quantitatively was based first on clinical homogeneity. Clinically homogeneous studies were defined as those with similar populations, interventions and outcomes measured at the same follow-up point. We pooled studies with sufficient data, judged to be clinically homogeneous, with RevMan 4.2.5 software. The scoring of a scale was reversed for the purposes of pooling if a high score denoted a good outcome (e.g. Voice-Related Quality of Life) instead of more pronounced dysphonia.

A rating system, based on the Levels of Evidence, was used to summarise the strength of scientific evidence of the effects of the treatment. The rating system is based on both the quality and the outcome of the studies (van Tulder 2003):

- I. Strong evidence - consistent evidence in multiple high quality randomised controlled trials
- II. Moderate evidence - consistent findings in multiple low quality randomised controlled trials and/or controlled clinical trials and/or one high quality randomised controlled trial
- III. Limited evidence - one low quality randomised controlled trial or controlled clinical trial
- IV. Conflicting evidence - inconsistent findings in multiple randomised controlled trials and/or controlled clinical trials
- V. No evidence - no randomised controlled trials or controlled clinical trials.

The outcome of the studies were considered 'consistent' if at least 75% of the trials reported statistically significant results in the same direction. There were not enough studies to conduct a sensitivity analysis to find out if quality level leads to changes.

Publication bias

We were planning to assess publication bias by means of a funnel plot but the low number of included studies made it impossible to make valid conclusions in this regard.

Methods for future updates

The authors intend to perform a new search for trials every two years and to update the review accordingly.

DESCRIPTION OF STUDIES

Study selection

From the initial set of 5937 references identified by the systematic searches, a set of 48 potentially eligible studies were identified. These were then scrutinised further with regard to our inclusion and exclusion criteria. Altogether 40 studies were excluded (see 'Characteristics of excluded studies' table) leaving a total of eight studies. However, we noticed that two studies (Beranova 2003 and Pedersen 2004) actually reported results of the same study so we excluded the one published later. The first was published in Czech and the later one in English. We felt that there was no reason to favour the latter just because of language. We also found out from the author himself that two studies (Carding 1992 and Carding 1999) actually used the same participants. We included the later one where more participants were added to the sample used in the previous study. Thus, our final sample consisted of six studies (see 'Characteristics of included studies' table).

Additional information regarding study details and/or statistical data was sought from six authors and was received from four. One of the authors provided statistical data that had not been published in his article.

Study designs

All six of the included studies were randomised controlled trials of person-directed interventions.

Country and time period

All of the included studies were conducted in Europe: three in the United Kingdom, one in Ireland, one in Denmark and one in Finland. One of the included studies was conducted in 1999 and five in 2001 or later.

Type of settings and participants

All of the interventions were carried out in clinical settings. In four of the studies the participants were consecutive patients in a speech and language therapy clinic. In Gillivan-Murphy 2005 the participants were teachers with self-reported symptoms who were recruited and in Simberg 2006 they were student teachers who were screened for inclusion.

Sample sizes

The total number of participants in the various intervention groups was 163, and in the control groups 141. The number of participants in the smallest study groups was less than 20 in three studies, between 20 and 60 in two studies, and more than 60 in

one study (MacKenzie 2001). This one study was the only one that had conducted *a priori* power calculations to ensure that experimental groups were large enough (i.e. there would be sufficient statistical power) to detect significant differences.

Interventions

We found the following types of interventions:

1. Direct voice therapy

No studies were found that evaluated the effectiveness of direct therapy alone. Direct techniques focus on the underlying physiological changes needed to improve an individual's technique in using the vocal system. Direct voice therapy usually consists of an individually tailored combination of some of the following techniques: specific laryngeal relaxation, yawn-sigh method, chewing technique, altering tongue position, diaphragmatic breathing, co-ordination of breathing with phonation, establishing and maintaining appropriate laryngeal tone, pitch variation and control, reduction of vocal loudness, elimination of glottal attack, establishing optimal pitch, voice 'placing', developing optimal resonance and maintenance and generalisation of optimal phonatory control.

2. Indirect voice therapy

One study (Carding 1999) looked at indirect voice therapy alone. Indirect techniques concentrate on the contributory and maintenance aspects of the voice disorder (such as lack of knowledge). This usually consists of an individually tailored combination of some of the following: patient education, reassurance, general relaxation, counselling, auditory training, elimination of abuse/misuse, voice diary, vocal hygiene program, avoidance of irritants, environmental awareness and voice conservation advice.

3. Combination of direct and indirect voice therapy

Five studies (Carding 1999; Gillivan-Murphy 2005; MacKenzie 2001; Rattenbury 2004 and Simberg 2006) examined the effectiveness of a combination of direct and indirect voice therapy. One study (Rattenbury 2004) looked at the added effect of patient feedback using trans-nasal flexible laryngoscopy (TFL). TFL is a tool that is widely used for diagnosis but can also be used to give a patient direct feedback on how treatment is affecting the behaviour of his or her vocal cords.

4. Other treatments

One study (Beranova 2003) compared the effectiveness of pharmacological treatment with vocal hygiene instructions given by phoniatrist. Pharmacological treatment consisted of treatment as deemed appropriate for allergy, infection, reflux or environmental irritants (e.g. dust or noise).

Outcomes measured

1. Primary outcomes: self-report measures

Three studies (Carding 1999; MacKenzie 2001 and Rattenbury 2004) used the Vocal Performance Questionnaire (Carding 1992). Two studies (Beranova 2003 and Gillivan-Murphy 2005) measured Voice-Related Quality of Life (Hogikyan 1999). One study

(Gillivan-Murphy 2005) used the Voice Symptom Severity scale (Deary 2003). One study used a questionnaire concerning the prevalence of seven vocal symptoms (Simberg 2006). See Table 02 for a description of the scales used, their minimum and maximum values and what they mean.

2.1. Secondary outcomes: observer-rated measures

Two studies (Rattenbury 2004 and Simberg 2006) measured voice quality with the GRBAS scale (Hirano 1989) whilst Carding 1999 used his own overall severity rating scale. One study (MacKenzie 2001) used the Buffalo Voice Profile (Wilson 1987). Three studies (Beranova 2003; Carding 1999 and MacKenzie 2001) performed laryngeal examinations. One study measured vocal fry and pitch (Simberg 2006).

2.2. Secondary outcomes: instrumental measures

Three studies (Carding 1999; MacKenzie 2001 and Rattenbury 2004) performed acoustic analyses. Two studies (Beranova 2003 and Carding 1999) measured fundamental frequency and/or intensity.

Type of control group

Four studies (Carding 1999; Gillivan-Murphy 2005; MacKenzie 2001 and Simberg 2006) employed a no intervention control group. Two studies (Beranova 2003 and Rattenbury 2004) compared two active interventions with one another.

Acceptability of treatment

As to drop-outs prior to randomisation or participants declining participation we found information on this topic in three of the six included studies. In Rattenbury 2004 four out of 24 subjects (17%) withdrew before randomisation. No information is given as to reasons why or about their personal characteristics. In Carding 1999 one patient declined to enter the study and was subsequently treated outside of the project. In Beranova 2003 there is a discrepancy in figures so that according to the text 18 patients were randomised but in the table of patient characteristics there are only 16 patients in the two groups. It is impossible to say if two patients were excluded or if it is a typing mistake. In general it seems that participation in treatment trials appears to be acceptable for functional dysphonia patients. We do not think this has had an effect on our results in relation to external validity.

Follow up

Four studies (Beranova 2003; Carding 1999; Gillivan-Murphy 2005 and Rattenbury 2004) conducted only before and immediately after intervention measurements. In fact, Carding 1999 apparently had done measurements immediately after the intervention but he only reported four-week follow-up scores and so these were entered as immediately after intervention data. Two studies (MacKenzie 2001 and Simberg 2006) followed up the long-term effectiveness of the interventions employed. The length of follow up differed from 14 weeks (MacKenzie 2001) to one year (Simberg 2006) although in the latter case only information from one

symptom questionnaire was available instead of data from all the measurements.

Excluded studies

Reasons for excluding the 40 studies were the following (see table of 'Characteristics of excluded studies'):

(a) No control group (Amir 2005; Andersson 1998; Birkent 2004; Broaddus-L. 2000; Fex 1994; Holbrook 1974; Jonsdottir 2001; Jonsdottir 2002; Kotby 1993; Laukkanen 2005; Lehto 2003; Lehto 2005; McCabe 2002; Milbrath 2003; Motel 2003; Prosek 1978; Roy 1993 and Roy 1997)

(b) Controlled study but no work-directed intervention (Andrews 1986; Garcia Real 2002; Mendoza-Lara 1990; Popovici 1993; Sliwiska-K. 2002; Zhao 2005)

(c) No intervention (John 2005 and Sellars 2002)

(d) Majority of participants had been diagnosed with a clearly organic voice disorder (Bassiouny 1998; Yiu 2005 and Zhao 2005)

(e) Participants were self-diagnosed and it is unclear if they had functional or organic voice disorders (Roy 2001; Roy 2002 and Roy 2003)

(f) Participants had no diagnosed voice problems (Bovo 2006; Chan 1994; Duffy 2004; Timmermans 2004a; Timmermans 2004b and Timmermans 2005). These studies were considered for inclusion in the prevention of voice disorders review (Ruotsalainen 2007).

(g) Duplicate publication (Pedersen 2004)

(h) Article is part of an ongoing study with more participants added later (Carding 1992).

METHODOLOGICAL QUALITY

The method of randomisation was adequate in two studies that employed computer generated random numbers (MacKenzie 2001 and Rattenbury 2004). In one study, allocation was by rotation which was considered inadequate (Carding 1999). In another study, after contacting the authors, it appeared that participants had assigned themselves into groups by drawing lots from a hat (Simberg 2006) which was also considered inadequate. We did not get information on the randomisation procedure of the other two studies which were therefore listed as unclear (see Table 03).

When it comes to the treatment of functional dysphonia the concealment of allocation into intervention and control groups is not an issue for participants as they cannot help but notice if they are receiving treatment or not. However, Rattenbury 2004 did not report if the randomisation procedure was concealed from the researchers.

All studies reported some descriptive data comparing the study groups after allocation thus portraying the acceptability of the randomisation procedure. MacKenzie 2001 reported that the groups were comparable for mean age, gender, laryngeal features and subjective and objective voice variables. Simberg 2006 reported baseline comparability only for mean age, whilst the remaining four

studies (Beranova 2003, Carding 1999, Gillivan-Murphy 2005 and Rattenbury 2004) reported also that some of the following items were comparable at baseline: age range, male to female ratio, laryngeal diagnosis, average duration of problems, mean onset of problems and years of teaching.

Blinding

When the blinding of those assessing the outcome was an issue, i.e. with secondary or observer-rated outcomes, the voice samples were assessed in each case by an independent panel of judges that were unaware of treatment allocation and participant identity. Studies that used observer-rated outcomes (i.e. where blinding was an issue) were Carding 1999; MacKenzie 2001; Rattenbury 2004 and Simberg 2006.

Attrition

The loss of participants was low throughout, with only two of the studies (MacKenzie 2001; Simberg 2006) suffering a loss exceeding 20% of the initial sample. MacKenzie 2001 states that: "The voice therapy and no treatment groups were not significantly different in terms of either rate of attrition (30% in the therapy group, 39% in the no treatment group) or characteristics of patients who dropped out (sociodemographic variables or baseline voice or psychological variables)". In the Simberg 2006 study there was differential attrition from study groups. There were no drop-outs from the treatment group and only one exclusion because of the need for immediate medical treatment, whereas nine subjects in the control group did not attend the second laryngeal examination (three months post onset) and four subjects did not return the questionnaire one year post onset (altogether 39% of the initial sample). MacKenzie 2001 was the only study to have conducted *a priori* power calculations to ensure that even with attrition there would be adequate statistical power to detect significant differences.

RESULTS

All the results are baseline versus immediately after intervention unless stated otherwise.

1. Direct voice therapy versus no intervention

No studies were found that evaluated the effectiveness of direct therapy separately.

2. Indirect voice therapy versus no intervention

2.1 Primary outcome: Self-report measures of vocal functioning

Carding 1999 did not find a difference in effectiveness between indirect voice therapy on its own and no intervention (mean difference -0.38; 95% CI -0.94 to 0.18) when measured with the Vocal Performance Questionnaire.

3. Combination of direct and indirect voice therapy versus no intervention

3.1 Primary outcome: Self-report measures of vocal functioning

A combination of direct and indirect voice therapy is effective in improving vocal functioning (SMD -1.07; 95% CI -1.94 to -0.19) when compared to no intervention and when measured with the Vocal Performance Questionnaire (VPQ) and the Voice-Related Quality of Life scale (Carding 1999; Gillivan-Murphy 2005 and MacKenzie 2001). When we transformed the effect size back to a score on the VPQ this yielded a mean difference of -11.3. This covers 25% of the range of the VPQ scale. There was considerable heterogeneity in this meta-analysis of direct and indirect interventions combined. Possible reasons for the heterogeneity are publication bias and differences in responsiveness to change of the scales used and in methodological quality of studies. It cannot be due to differences in sample (e.g. vocal loading) because Carding 1999 used consecutive patients and Gillivan-Murphy 2005 used volunteer teachers and their results were nonetheless quite similar. The difference between MacKenzie 2001 and the other two studies is probably due to higher methodological quality which has led to more realistic results.

3.1.2 Long-term follow up of self-reported vocal functioning

The results of MacKenzie 2001 show that the intervention group's vocal performance remained better than the control group's at 14 weeks' follow up (SMD -0.51; 95% CI -0.87 to -0.14). According to the results of Simberg 2006 the intervention group's number of voice-related symptoms also remained lower for a year.

3.2 Secondary outcome: Observer-rated measurement of vocal quality Buffalo Voice Profile

A combination intervention has no initial effect on voice quality (WMD -0.20; 95% CI -0.51 to 0.11) when compared to no intervention and when measured with the Buffalo Voice Profile immediately following the intervention (MacKenzie 2001). However, after 14 weeks of follow-up the same measurement becomes significant meaning that the voice quality of patients in the intervention group had improved (WMD -0.80; 95% CI -1.14 to -0.46).

GRBAS - Grade

The results of Simberg 2006 show the combination of direct and indirect voice therapy as being effective in improving vocal functioning (WMD -13.00; 95% CI -17.92 to -8.08) when compared to no intervention and when measured with GRBAS overall Grade.

3.3 Secondary outcome: Instrumental measurement of vocal quality Pitch perturbation (jitter)

MacKenzie 2001 shows that a combination of direct and indirect voice therapy is not effective in improving vocal functioning when compared to no intervention and when measured with pitch perturbation immediately following intervention (WMD 0.00; 95% CI -0.53 to 0.53) or after 14 weeks of follow up (WMD 0.50; 95% CI -0.04 to 1.04).

Amplitude perturbation (shimmer)

According to the results of MacKenzie 2001 a combination of direct and indirect voice therapy is effective in improving vocal func-

tioning when compared to no intervention and when measured with amplitude perturbation immediately following intervention (WMD -1.20; 95% CI -2.37 to -0.03) but not at 14 weeks of follow up (mean difference -0.40; 95% CI -1.61 to 0.81).

4. Combination of direct and indirect voice therapy versus combination therapy with biofeedback

According to the results of Rattenbury 2004, TFL-assisted treatment is not more effective than just a combination of direct and indirect treatment approaches (WMD -2.40; 95% CI -0.76 to 5.56) when measured with the Vocal Performance Questionnaire. The patient contact treatment time for the TFL-treatment was on average two thirds (two hours) less than the time needed for the traditional approach.

5. Other treatments

Beranova 2003 reported that there were no significant differences between pharmacological treatment and vocal hygiene instructions given by phoniatrist but since she did not report standard deviations this could not be verified statistically.

Subgroup analyses

Because interventions might work differently with groups with heavy vocal load we looked separately at studies that included only workers. There were two studies that screened teachers or teacher students for vocal problems (Gillivan-Murphy 2005 and Simberg 2006). The severity of problems in these studies was about 25% of the maximum attainable unfavourable score. This was slightly lower than the patient studies (Carding 1999 and MacKenzie 2001) with 58% and 33% respectively. The outcomes were comparable between patient and teacher studies. Both teacher studies had a positive outcome.

Publication bias

We included studies that compared any intervention with no intervention control because we felt that these would yield similar results. The number of studies is too low for drawing any valid conclusions from a funnel plot.

DISCUSSION

The meta-analyses in this review show that there is moderate evidence for the effectiveness of a combination of direct and indirect voice therapy on vocal functioning when compared to no intervention. There is also moderate evidence from one study that the remedial effect of a combination of direct and indirect voice therapy as measured with patient-reported vocal performance or with observer-rated perceptual assessment (Buffalo Voice Profile) remains significant for at least 14 weeks. There is limited evidence from another study that the number of symptoms may remain lower for a year.

Carding 2000 states that direct and indirect modes of intervention are not mutually exclusive as some indirect treatment is usually

also incorporated in direct treatment. He writes that indirect approaches are based on the assumption that inappropriate phonatory behaviour is a symptom of excessive demands on the voice, abusive behaviours, personal anxiety and tension levels and a lack of knowledge regarding healthy voice production. Direct voice therapy is based on the assumption that the patient with functional dysphonia has adopted an incorrect and potentially damaging mode of voice production. Direct techniques aim to identify the inappropriate pattern of phonation and to enable the patient to correct her phonatory function.

This categorisation of interventions into direct and indirect modes is only one way to describe the contents of voice therapy. There are also many other ways to divide voice therapy approaches. For example, Stemple 2000 has divided voice therapy into symptomatic, psychogenic, hygienic, eclectic and physiological approaches. Boone 2005 has categorised voice therapies into cognitive, gestalt-holistic, resonant therapy, vocal function exercise, visualisation and symptomatic therapy approaches. It is important to remember that all categorisations of the various ways in which the voice can be treated are somewhat arbitrary and that therapists will in any case use a combination of methods to meet the individual needs of each patient (Boone 2005).

The methodological quality of included studies was mostly poor. Most randomised controlled trials were small and in all but two of the included randomised controlled trials (MacKenzie 2001 and Rattenbury 2004) the method of randomisation was not reported or not valid. It was also difficult to get a good impression of the concealment of allocation from researchers. We assumed that outcomes that were measured by questionnaire were reported blind to the researchers but we could not be certain about this assumption. The reporting of some studies was of low quality as well which is reflected in having to contact the authors for further information. According to our classification of the studies, only one of the six studies (MacKenzie 2001) was high quality in terms of randomisation, allocation concealment, blinding and dealing with attrition. The results of this high quality study are consistent with the overall conclusions of this systematic review. We did not find any studies of work-directed/environmental interventions that satisfied our inclusion criteria.

To make sure we did not overlook any relevant evidence we also present an overview of published controlled non-randomised trials of person-directed voice treatment interventions (see Table 01). Two studies (Popovici 1993 and Sliwinska-K. 2002) had results that are in line with the conclusions of the randomised trials meaning that voice therapy is effective in both teachers and in patients. One study (Garcia Real 2002) found a therapeutic benefit for hydration with or without voice training and another study (Mendoza-Lara 1990) found that EMG biofeedback training was effective. One study (Andrews 1986), did not find any significant differences between EMG biofeedback training and progressive relaxation. No trials were found with results clearly refuting the

effectiveness of voice therapy or with results showing harmful effects.

Since most of the studies were small and reported positive outcomes it is conceivable that there may have been publication bias involved. Language bias was corrected for by not having language restrictions in the systematic search strategy and by translating articles written in languages that the authors were not proficient in. Only two of the six non-randomised controlled trials initially considered for inclusion had been published in English, another two were published in Spanish, one in Polish and one in Romanian.

Clinical relevance

Even though the result of the meta-analysis was significant and it covered 25% of the range of the Vocal Performance Questionnaire after transformation, we cannot be sure how this is related to the clinical relevance of the changes achieved in the studies. There is no generally accepted change in the two self-report measures used (Vocal Performance Questionnaire and Voice-Related Quality of Life) that would be regarded as clinically relevant. Studies are needed to determine what is the relation between a change score on the questionnaires and an important amount of change in outcome as rated by patients (cf. Stratford 2005).

Comparison with other reviews

There are no previous reports of systematic reviews or meta-analyses available in the literature that are concerned with voice therapy or interventions for treating functional dysphonia. Previous narrative literature reviews or overviews (Carding 2000; Oates 2004 and Ramig 1998) have identified altogether a total of 87 articles, published between 1960 and 2001, that have evaluated the effectiveness of voice therapy. According to Oates 2004, 12 of the 87 published studies can be categorised as randomised controlled trials. Half of these have investigated treatment methods for patients with Parkinson's disease whilst the remainder have evaluated the accent method in patients with various aetiologies, vocal function exercises in subjects with normal voice and in teachers. Only two of the studies included in these previous reviews (Carding 1999; MacKenzie 2001) have studied the effectiveness of voice therapy for functional dysphonia. Both studies were included in this review. It is also important to note that the definition of functional dysphonia is not synonymous across studies. Functional dysphonia, psychogenic dysphonia, mechanical dysphonia, muscle tension dysphonia, functional voice disorder, hyperfunctional voice, hyperfunctional dysphonia and non-organic dysphonia have all been used to describe dysphonia in the absence of organic pathology. The latest addition to this abundance of terminology is Verdolini's concept of phonotrauma. It adds greatly to the difficulty of comparing and combining studies when they are seemingly dealing with different issues.

AUTHORS' CONCLUSIONS

Implications for practice

A combination of direct and indirect voice therapy should be considered as a primary or best available intervention method for functional dysphonia at the moment. The diagnosis 'functional dysphonia' does not, however, in itself reveal what aspects of vocal or speech production (pitch, loudness, intonation, phonation, tempo, breathing, resonance or overall tension) needs to be modified. The therapist must choose the aims and the specific techniques of voice therapy accordingly. Screening and subsequently treating teachers and student teachers is a feasible approach and yields positive results. Before widespread implementation can be recommended better quality studies are needed.

Implications for research

Given the high volume of dysphonia treatment, more research evaluating the effects of treatment is needed. Our review contains one high quality study (MacKenzie 2001) only which indicates a need for more high quality studies. These future studies should include randomisation of participants to intervention and control groups and have sufficient statistical power to detect a mean change of ten points on the Vocal Performance Questionnaire. Having access to only small numbers of participants can be overcome by organising a multi-centre study. As participants, persons with a high vocal load should particularly be included. The interventions should involve both direct and indirect techniques but according to a well designed protocol. The comparison should still be a no intervention, observation only control group, or if this is deemed unacceptable a minimal intervention only. Assuming that the interventions are aiming at improving vocal performance, outcome should be measured with a validated questionnaire such as the Voice Handicap Index (Jacobson 1999) and be blind for researchers and care-providers. To be able to better judge the outcome, research is needed to determine a clinically relevant change on these questionnaires. Even though trans-nasal flexible laryngoscopy (TFL) assisted treatment was not more effective than a combination of direct and indirect voice therapy, it might be more efficient. This should be studied in an economic evaluation.

POTENTIAL CONFLICT OF INTEREST

Jaana Sellman is one of the authors of one of the included articles (Simberg 2006).

ACKNOWLEDGEMENTS

Mari Qvarnström and Anita Länsivuori From Kuopio University Hospital provided valuable insight into the everyday practice of

voice assessment and therapy. Felix de Jong and Eeva Sala gave their advice when we were in the beginning stages with the protocol. Maria Hirvonen assisted with statistical calculations. Carolyn Doree from the Cochrane ENT Group provided advice regarding our search strategies. Patricia Gillivan-Murphy, Nelson Roy, Paul Carding and Susanna Simberg provided us further information about their studies. Finally, an especially warm thank you to Katarina Kulhankova, Ligia Grindenau and Consol Serra for your help in translating articles from Czech, Romanian and Spanish to English.

SOURCES OF SUPPORT

External sources of support

- Pension Fund Loyalis NETHERLANDS

Internal sources of support

- Ministry of Social Affairs and Health FINLAND
- Cochrane Occupational Health Field FINLAND

REFERENCES

References to studies included in this review

- Beranova 2003** *{published data only}*
Beranova A, Betka J. New opportunities in the treatment of dysphonia. *Otorinolaryngologie a Foniatrie* 2003;**52**:75–9.
- Carding 1999** *{published data only}*
Carding PN, Horsley IA, Docherty GJ. A study of the effectiveness of voice therapy in the treatment of 45 patients with nonorganic dysphonia. *Journal of Voice* 1999;**13**(1):72–104.
- Gillivan-Murphy 2005** *{published data only}*
Gillivan-Murphy P, Drinnan MJ, O'Dwyer TP, Ridha H, Carding P. The Effectiveness of a Voice Treatment Approach for Teachers With Self-Reported Voice Problems. *Journal of Voice* 2005;**20**(3):423–31.
- MacKenzie 2001** *{published data only}*
MacKenzie K, Millar A, Wilson JA, Sellars C, Deary IJ. Is voice therapy an effective treatment for dysphonia? A randomised controlled trial. *BMJ* 2001;**323**(7314):658–61.
- Rattenbury 2004** *{published data only}*
Rattenbury HJ, Carding PN, Finn P. Evaluating the effectiveness and efficiency of voice therapy using transnasal flexible laryngoscopy: a randomized controlled trial. *Journal of Voice* 2004;**18**:522–33.
- Simberg 2006** *{published data only}*
Simberg S, Sala E, Tuomainen J, Sellman J, Ronnema AM. The Effectiveness of Group Therapy for Students With Mild Voice Disorders: A Controlled Clinical Trial. *Journal of Voice* 2006;**20**(1):97–109.

References to studies excluded from this review

- Amir 2005**
Amir O, Dukas M, Shnaps-Baum R. The effect of a 'voice course' on the voices of people with and without pathologies: preliminary observations. *Logopedics, Phoniatrics, Vocology* 2005;**30**(2):63–71.
- Andersson 1998**
Andersson K, Schalen L. Etiology and treatment of psychogenic voice disorder: results of a follow-up study of thirty patients. *Journal of Voice* 1998;**12**(1):96–106.
- Andrews 1986**
Andrews S, Warner J, Stewart R. EMG biofeedback and relaxation in the treatment of hyperfunctional dysphonia. *The British Journal of Disorders of Communication* 1986;**21**(3):353–69.
- Bassiouny 1998**
Bassiouny S. Efficacy of the accent method of voice therapy. *Folia Phoniatrica et Logopaedica* 1998;**50**:146–64.
- Birkent 2004**
Birkent H, Akçam T, Gerek M, Ertas I, Ozkaptan Y. Results of voice therapy in functional voice disorders. *Kulak burun bogaz iltisaz der-gisi: KBB = Journal of Ear, Nose, and Throat* 2004;**12**:120–7.
- Bovo 2006**
Bovo R, Galceran M, Petruccelli J, Hatzopoulos S. Vocal Problems Among Teachers: Evaluation of a Preventive Voice Program. *Journal of Voice* 2006;**(In Press)**.
- Broaddus-L. 2000**
Broaddus-Lawrence PL, Treole K, McCabe RB, Allen RL, Toppin L. The effects of preventive vocal hygiene education on the vocal hygiene habits and perceptual vocal characteristics of training singers. *Journal of Voice* 2000;**14**(1):58–71.

- Carding 1992**
Carding PN, Horsley IA. An evaluation study of voice therapy in non-organic dysphonia. *European Journal of Disorders of Communication* 1992;27:137–58.
- Carding 1998**
Carding PN, Horsley IA, Docherty GJ. The effectiveness of voice therapy for patients with non-organic dysphonia. *Clinical Otolaryngology and Allied Sciences* 1998;23(4):310–8.
- Chan 1994**
Chan RW. Does the voice improve with vocal hygiene education? A study of some instrumental voice measures in a group of kindergarten teachers. *Journal of Voice* 1994;8(3):279–91.
- Duffy 2004**
Duffy OM, Hazlett DE. The impact of preventive voice care programs for training teachers: a longitudinal study. *Journal of Voice* 2004;18(1):63–70.
- Fex 1994**
Fex B, Fex S, Shiromoto O, Hirano M. Acoustic analysis of functional dysphonia: before and after voice therapy (accent method). *Journal of Voice* 1994;8(2):163–7.
- Garcia Real 2002**
Garcia Real T, Garcia Real A, Diaz RT, Canizo Fernandez RA. [The outcome of hydration in functional dysphonia]. *Anales Otorrinolaringológicos Ibero-americanos* 2002;29(4):377–91.
- Holbrook 1974**
Holbrook A, Rolnick MI, Bailey CW. Treatment of vocal abuse disorders using a vocal intensity controller. *The Journal of Speech and Hearing Disorders* 1974;39(3):298–303.
- John 2005**
John A, Enderby P, Hughes A. Comparing outcomes of voice therapy: A benchmarking study using the therapy outcome measure. *Journal of Voice* 2005;19(1):114–23.
- Jonsdottir 2001**
Jonsdottir V, Rantala L, Laukkanen AM, Vilkmán E. Effects of sound amplification on teachers' speech while teaching. *Logopedics, Phoniatrics, Vocology* 2001;26(3):118–23.
- Jonsdottir 2002**
Jonsdottir V, Laukkanen AM, Vilkmán E. Changes in teachers' speech during a working day with and without electric sound amplification. *Folia Phoniatrica et Logopaedica* 2002;54(6):282–7.
- Kotby 1993**
Kotby MN, Shiromoto O, Hirano M. The accent method of voice therapy: effect of accentuations on FO, SPL, and airflow. *Journal of Voice* 1993;7(4):319–25.
- Laukkanen 2005**
Laukkanen AM, Leppanen K, Tyrmi J, Vilkmán E. Immediate effects of 'voice massage' treatment on the speaking voice of healthy subjects. *Folia Phoniatrica et Logopaedica* 2005;57(3):163–72.
- Lehto 2003**
Lehto L, Rantala L, Vilkmán E, Alku P, Backstrom T. Experiences of a short vocal training course for call-centre customer service advisors. *Folia Phoniatrica et Logopaedica* 2003;55(4):163–76.
- Lehto 2005**
Lehto L, Alku P, Backstrom T, Vilkmán E. Voice symptoms of call-centre customer service advisors experienced during a work-day and effects of a short vocal training course. *Logopedics, Phoniatrics, Vocology* 2005;30(1):14–27.
- McCabe 2002**
McCabe DJ, Titze IR. Chant therapy for treating vocal fatigue among public school teachers: A preliminary study. *American Journal of Speech-Language Pathology* 2002;11(3):356–69.
- Mendoza-Lara 1990**
Mendoza-Lara E. Behavioral treatment of professional dysphonias [Tratamiento conductual de las disfonias profesionales]. *Análisis y modificación de conducta* 1990;16(48):275–309.
- Milbrath 2003**
Milbrath RL, Solomon NP. Do vocal warm-up exercises alleviate vocal fatigue?. *Journal of Speech, Language, and Hearing Research* 2003;46(2):422–36.
- Motel 2003**
Motel T, Fisher KV, Leydon C. Vocal warm-up increases phonation threshold pressure in soprano singers at high pitch. *Journal of Voice* 2003;17(2):160–7.
- Pedersen 2004**
Pedersen M, Beranova A, Moller S. Dysphonia: medical treatment and a medical voice hygiene advice approach. A prospective randomised pilot study. *European Archives of Oto-rhino-laryngology* 2004;261(6):312–5.
- Popovici 1993**
Popovici C. The role of psychotherapy in the treatment of voice disturbances [Aportul psihoterapiei de relaxare la ameliorarea tulburarilor vocale]. *Rev Psih* 1993;39(3):225–37.
- Prosek 1978**
Prosek RA, Montgomery AA, Walden BE, Schwartz DM. EMG biofeedback in the treatment of hyperfunctional voice disorders. *Journal of Speech and Hearing Disorders* 1978;43(3):282–94.
- Roy 1993**
Roy N, Leeper HA. Effects of the manual laryngeal musculoskeletal tension reduction technique as a treatment for functional voice disorders: perceptual and acoustic measures. *Journal of Voice* 1993;7(3):242–9.
- Roy 1997**
Roy N, Bless DM, Heisey D, Ford CN. Manual circumlaryngeal therapy for functional dysphonia: an evaluation of short- and long-term treatment outcomes. *Journal of Voice* 1997;11(3):321–31.
- Roy 2001**
Roy N, Gray SD, Simon M, Dove H, Corbin-Lewis K, Stemple JC. An evaluation of the effects of two treatment approaches for teachers with voice disorders: a prospective randomized clinical trial. *Journal of Speech, Language, and Hearing Research* 2001;44(2):286–96.
- Roy 2002**
Roy N, Weinrich B, Gray SD, Tanner K, Toledo SW, Dove H, Corbin LK, Stemple JC. Voice amplification versus vocal hygiene instruction for teachers with voice disorders: a treatment outcomes study. *Journal of Speech, Language, and Hearing Research* 2002;45:625–38.
- Roy 2003**
Roy N, Weinrich B, Gray SD, Tanner K, Stemple JC, Sapienza CM. Three treatments for teachers with voice disorders: a randomized clinical trial. *Journal of Speech, Language, and Hearing Research* 2003;46(3):670–88.

Sellars 2002

Sellars C, Carding PN, Deary IJ, MacKenzie K, Wilson JA. Characterization of effective primary voice therapy for dysphonia. *Journal of Laryngology and Otology* 2002;**116**(12):1014–8.

Sliwiska-K. 2002

Sliwiska-Kowalska M, Fiszer M, Kotylo P, Ziatkowska E, Stepowska M, Niebudek-Bogusz E. [Effect of voice emission training on the improvement in voice organ function among students attending the college of teachers]. *Medycyna Pracy* 2002;**53**(3):229–32.

Timmermans 2004a

Timmermans B, De BM, Wuyts F, Van de HP. Voice quality change in future professional voice users after 9 months of voice training. *European Archives of Oto-rhino-laryngology* 2004;**261**(1):1–5.

Timmermans 2004b

Timmermans B, De Bodt MS, Wuyts FL, Van de Heyning PH. Training outcome in future professional voice users after 18 months of voice training. *Folia Phoniatrica et Logopaedica* 2004;**56**(2):120–9.

Timmermans 2005

Timmermans B, De Bodt MS, Wuyts FL, Van de Heyning PH. Analysis and evaluation of a voice-training program in future professional voice users. *Journal of Voice* 2005;**19**(2):202–10.

Yiu 2005

Yiu E, Xu JJ, Murry T, Wei WI, Yu M, Ma E, Huang W, Kwong EY. A Randomized Treatment-Placebo Study of the Effectiveness of Acupuncture for Benign Vocal Pathologies. *Journal of Voice* 2006;**20**(1):144–56.

Zhao 2005

Zhao YQ, Zhang LF, Li SQ, Sun YZ. Psycho-intervention and speech training for mutational falsettos. *Chinese Journal of Clinical Rehabilitation* 2005;**9**(20):55–7.

Additional references**Aronson 1985**

Aronson AE. *Clinical voice disorders*. 2nd Edition. New York: Thieme Inc, 1985.

Boone 1983

Boone DR. *Voice and voice therapy*. 3rd Edition. London: Prentice-Hall, 1983.

Boone 1987

Boone DR. *Human communication and its disorders*. Englewood Cliffs, New Jersey: Prentice-Hall, 1987.

Boone 1993

Boone DR, McFarlane SC. A critical view of the yawn-sigh as a voice therapy technique. *Journal of Voice* 1993;**7**(1):75–80.

Boone 2005

Boone DR, MacFarlane SC, von Berg SL. *The voice and voice therapy*. Boston, MA: Pearson/Allyn & Bacon, 2005.

Carding 2000

Carding P. *Evaluating voice therapy: Measuring the effectiveness of treatment*. London: Whurr Publishers, 2000.

Colton 2006

Colton R, Casper J, Leonard R. *Understanding Voice Problems. A Physiological Perspective for Diagnosis and Treatment*. 3rd Edition. Baltimore Philadelphia: Lippincott Williams & Wilkins, 2006.

Deary 2003

Deary IJ, Wilson JA, Carding PN, MacKenzie K. VoiSS: a patient-derived Voice Symptom Scale. *Journal of Psychosomatic Research* 2003;**54**(5):483–9.

Dejonckere 2001

Dejonckere PH, Bradley P, Clemente P, Cornut G, Crevier-Buchman L, Friedrich G, Van De HP, Remacle M, Woisard V. A basic protocol for functional assessment of voice pathology, especially for investigating the efficacy of (phonosurgical) treatments and evaluating new assessment techniques. Guideline elaborated by the Committee on Phoniatrics of the European Laryngological Society (ELS). *European Archives of Oto-rhino-laryngology* 2001;**258**(2):77–82.

Enderby 1995

Enderby P, Emmerson R. *Does speech and language therapy work? A review of the literature*. London: Whurr Publishers, 1995.

Fawcus 1986

Fawcus M. *Voice disorders and their management*. 2nd Edition. London: Chapman & Hall, 1986.

Hartl 2005

Hartl DM, Hans S, Crevier BL, Laccourreye O, Vaissiere J, Brasnu D. Dysphonia: current methods of evaluation [Méthodes actuelles d'évaluation des dysphonies]. *Annales d'Oto-laryngologie et de Chirurgie Cervico Faciale* 2005;**122**(4):163–72.

Herrington-Hall 1988

Herrington-Hall BL, Lee L, Stemple JC, Niemi KR, McHone MM. Description of laryngeal pathologies by age, sex, and occupation in a treatment-seeking sample. *Journal of Speech and Hearing Disorders* 1988;**53**(1):57–64.

Hirano 1989

Hirano M. Objective evaluation of the human voice: clinical aspects. *Folia Phoniatrica (Basel)* 1989;**41**(2-3):89–144.

Hogikyan 1999

Hogikyan ND, Sethuraman G. Validation of an instrument to measure voice-related quality of life (V-RQOL). *Journal of Voice* 1999;**13**(4):557–69.

Jacobson 1999

Jacobson BH, Johnson A, Grywalski C, Silbergleit A, Jacobson G, Benninger MS, Newman CW. The voice handicap index: development and validation. *American Journal of Speech-Language Pathology* 1999;**6**:66–70.

Jasper 2000

Jasper JK, Colton R. Current understanding and treatment of phonatory disorders in geriatric populations. *Current Opinion in Otolaryngology & Head and Neck Surgery* 2000;**8**:158–64.

Ma 2001

Ma EP, Yiu EM. Voice activity and participation profile: assessing the impact of voice disorders on daily activities. *Journal of Speech, Language, and Hearing Research* 2001;**44**(3):511–24.

Oates 2004

Oates J. The evidence base for the management of individuals with voice disorders. In: Reilly S, Douglas J, Oates J editor(s). *Evidence-based practice in speech pathology*. London – Philadelphia: Whurr Publishers, 2004:110–39.

- Ramig 1998**
Ramig LO, Verdolini K. Treatment efficacy: voice disorders. *Journal of Speech, Language, and Hearing Research* 1998;**41**(1):S101–S116.
- Robinson 2002**
Robinson KA, Dickersin K. Development of a highly sensitive search strategy for the retrieval of reports of controlled trials using PubMed. *International Journal of Epidemiology* 2002;**31**(1):150–3.
- Ruotsalainen 2007**
Ruotsalainen JH, Lehto L, Sellman J, Jauhiainen M, Verbeek JH. Interventions for preventing voice disorders in adults [Protocol]. *Cochrane Database of Systematic Reviews* 2007, Issue 1. DOI: [10.1002/14651858](https://doi.org/10.1002/14651858).
- Russell 1998**
Russell A, Oates J, Greenwood KM. Prevalence of voice problems in teachers. *Journal of Voice* 1998;**12**(4):467–79.
- Sataloff 2000**
Sataloff RT, Abaza MM. Impairment, disability, and other medical-legal aspects of dysphonia. *Otolaryngologic Clinics of North America* 2000;**33**(5):1143–52.
- Seifert 2005**
Seifert E, Kollbrunner J. Stress and distress in non-organic voice disorder. *Swiss Medical Weekly* 2005;**135**(27–28):387–97.
- Slim 2003**
Slim K, Nini E, Forestier D, Kwiatkowski F, Panis Y, Chipponi J. Methodological index for non-randomized studies (minors): development and validation of a new instrument. *ANZ Journal of Surgery* 2003;**73**(9):712–6.
- Smith 1997**
Smith E, Gray SD, Dove H, Kirchner L, Heras H. Frequency and effects of teachers' voice problems. *Journal of Voice* 1997;**11**(1):81–7.
- Stemple 1995**
Stemple JC, Stanley J, Lee L. Objective measures of voice production in normal subjects following prolonged voice use. *Journal of Voice* 1995;**9**(2):127–33.
- Stemple 2000**
Stemple JC, Glaze LE, Gerdeman BK. *Clinical voice pathology: Theory and management*. San Diego California: Singular Publishing Group, 2000.
- Stratford 2005**
Stratford PW, Riddle DL. Assessing sensitivity to change: choosing the appropriate change coefficient. *Health Qual Life Outcomes* 2005;**3**:23.
- Szeszenia-D. 2005**
Szeszenia-Dabrowska N, Wilczynska U, Szymczak W. [Occupational diseases in Poland, 2004]. *Medycyna Pracy* 2005;**56**(4):275–84.
- Titze 1994**
Titze IR. *Principles of voice production*. Englewood Cliffs, New Jersey: Prentice-Hall, Inc, 1994.
- van Tulder 2003**
van Tulder M, Furlan A, Bombardier C, Bouter L. Updated method guidelines for systematic reviews in the Cochrane Collaboration Back Review Group. *Spine* 2003;**28**(12):1290–9.
- Verbeek 2005**
Verbeek J, Salmi J, Pasternack I, Jauhiainen M, Laamanen I, Schaafsma F, Hulshof C, van DF. A search strategy for occupational health intervention studies. *Occupational and Environmental Medicine* 2005;**62**(10):682–7.
- Verdolini 2001**
Verdolini K, Ramig LO. Review: occupational risks for voice problems. *Logopedics, Phoniatrics, Vocology* 2001;**26**(1):37–46.
- Vilkman 2004**
Vilkman E. Occupational safety and health aspects of voice and speech professions. *Folia Phoniatrica et Logopaedica* 2004;**56**(4):220–53.
- Wilson 1987**
Wilson DK. *Voice Problems in Children*. 3rd Edition. Baltimore, MD: Williams & Wilkins, 1987.
- Wilson 1995**
Wilson JA, Deary IJ, Scott S, MacKenzie K. Functional dysphonia. *BMJ* 1995;**311**(7012):1039–40.

TABLES

Characteristics of included studies

Study	Beranova 2003
Methods	Randomised controlled trial
Participants	16 consecutive patients with dysphonia persisting for more than two weeks
Interventions	1) Indirect treatment (9) 2) Pharmacotherapy (7)
Outcomes	1) Voice-Related Quality of Life 2) Videostroboscopy; Phonetogram
Notes	

Characteristics of included studies (Continued)

Allocation concealment D – Not used

Study	Carding 1999
Methods	Randomised controlled trial
Participants	45 patients diagnosed with non-organic dysphonia
Interventions	1) Indirect treatment (15) 2) Direct and indirect treatment (15) 3) No intervention (15)
Outcomes	1) Vocal Performance Questionnaire 2) Auditory voice quality ratings; Laryngoscopy; Laryngography; Fundamental Frequency analysis; Acoustic analysis
Notes	
Allocation concealment	D – Not used

Study	Gillivan-Murphy 2005
Methods	Randomised controlled trial
Participants	20 teachers with self-reported voice/throat symptoms
Interventions	1) Direct and indirect treatment (10) 2) No intervention (10)
Outcomes	1) Voice-Related Quality of Life; Voice symptom scale 2) Voice care knowledge VAS
Notes	
Allocation concealment	D – Not used

Study	MacKenzie 2001
Methods	Randomised controlled trial
Participants	133 outpatients with persistent hoarseness for at least two months
Interventions	1) Direct and indirect treatment (70) 2) No intervention (63)
Outcomes	1) Vocal Performance Questionnaire 2) Laryngeal rating; Buffalo Voice Profile; amplitude and pitch perturbation
Notes	
Allocation concealment	A – Adequate

Study	Rattenbury 2004
Methods	Randomised controlled trial
Participants	50 consecutive patients with muscle tension dysphonia (MTD)
Interventions	1) Direct and indirect treatment (26) 2) TFL-assisted voice therapy (24)
Outcomes	1) Vocal Performance Questionnaire 2) GRBAS; amplitude and pitch perturbation
Notes	
Allocation concealment	B – Unclear

Study	Simberg 2006
Methods	Randomised controlled trial
Participants	40 teacher students screened as having a voice disorder: reporting two or more voice symptoms weekly or more and/or observed deviant voice quality
Interventions	1) Direct and indirect group treatment (20) 2) No intervention (20)
Outcomes	2) GRBAS; vocal fry and pitch
Notes	
Allocation concealment	D – Not used

Characteristics of excluded studies

Study	Reason for exclusion
Amir 2005	ALLOCATION: Not randomised.
Andersson 1998	ALLOCATION: Not randomised.
Andrews 1986	ALLOCATION: Not randomised.
Bassiouny 1998	ALLOCATION: Randomised. PARTICIPANTS: Included patients with vocal fold immobility (paralysis).
Birkent 2004	ALLOCATION: Not randomised.
Bovo 2006	ALLOCATION: Randomised. PARTICIPANTS: Included patients without any voice problems.
Broaddus-L. 2000	ALLOCATION: Not randomised.
Carding 1992	ALLOCATION: Randomised. PARTICIPANTS: Included patients are in part the same individuals as in Carding 1999.
Carding 1998	ALLOCATION: Randomised. PARTICIPANTS: Included patients are in part the same individuals as in Carding 1999.
Chan 1994	ALLOCATION: Not randomised.
Duffy 2004	ALLOCATION: Randomised. PARTICIPANTS: Included patients without any voice problems.

Fex 1994	ALLOCATION: Not randomised.
Garcia Real 2002	ALLOCATION: Not randomised.
Holbrook 1974	ALLOCATION: Not randomised.
John 2005	ALLOCATION: Not randomised.
Jonsdottir 2001	ALLOCATION: Not randomised.
Jonsdottir 2002	ALLOCATION: Not randomised.
Kotby 1993	ALLOCATION: Not randomised.
Laukkanen 2005	ALLOCATION: Not randomised.
Lehto 2003	ALLOCATION: Not randomised.
Lehto 2005	ALLOCATION: Not randomised.
McCabe 2002	ALLOCATION: Not randomised.
Mendoza-Lara 1990	ALLOCATION: Not randomised.
Milbrath 2003	ALLOCATION: Not randomised.
Motel 2003	ALLOCATION: Not randomised.
Pedersen 2004	ALLOCATION: Randomised. PARTICIPANTS: Included patients are the same individuals as in Beranova 2003. The two articles are identical apart from language.
Popovici 1993	ALLOCATION: Not randomised.
Prosek 1978	ALLOCATION: Not randomised.
Roy 1993	ALLOCATION: Not randomised.
Roy 1997	ALLOCATION: Not randomised.
Roy 2001	ALLOCATION: Randomised. PARTICIPANTS: Included patients without a diagnosis of functional dysphonia.
Roy 2002	ALLOCATION: Randomised. PARTICIPANTS:

Characteristics of excluded studies (Continued)

	Included patients without a diagnosis of functional dysphonia.
Roy 2003	ALLOCATION: Randomised. PARTICIPANTS: Included patients without a diagnosis of functional dysphonia.
Sellars 2002	ALLOCATION: Not randomised.
Sliwinska-K. 2002	ALLOCATION: Not randomised.
Timmermans 2004a	ALLOCATION: Not randomised.
Timmermans 2004b	ALLOCATION: Not randomised.
Timmermans 2005	ALLOCATION: Not randomised.
Yiu 2005	ALLOCATION: Randomised. PARTICIPANTS: The majority of included patients had organic dysphonia.
Zhao 2005	ALLOCATION: Not randomised.

ADDITIONAL TABLES

Table 01. Controlled (Non-randomised) Trials

Study ID	Methods	Participants	Interventions	Outcomes	Results
Andrews 1986	Controlled trial	10 female subjects matched based on age and dysphonia severity	1) EMG biofeedback training (5) 2) Progressive relaxation training (5)	Laryngeal muscle tension, control of vocal fold vibration, auditory evaluation, personality measures, self-rating of voice, laryngoscopy	Both interventions effective; no significant difference between groups.
Garcia Real 2002	Controlled trial	75 professional voice users with a minimum of four hours of daily voice use and who had had in the past symptoms or signs of vocal damage due to voice use for a minimum of six months	1) Hydration treatment (27) 2) Hydration and direct treatment (25) 3) No intervention (23)	Laryngoscopy, maximum phonation time, speaking time and fundamental frequency	Both interventions effective; no significant difference between groups.
Mendoza-Lara 1990	Controlled trial	14 dysphonic	1) Traditional	Auditory voice	Both interventions

Table 01. Controlled (Non-randomised) Trials (Continued)

Study ID	Methods	Participants	Interventions	Outcomes	Results
		teachers and 14 teachers without voice problems	treatment (7) 2) EMG biofeedback training (7) 3) No intervention (14)	quality ratings (intensity, tone, dysphonia, timbre, roughness, breathiness)	effective; significant differences between treatment and control; no significant difference between treatments.
Popovici 1993	Controlled trial	39 patients suffering from psychosomatic or conversive voice problems	1) Classical therapy and relaxation (24) 2) Classical therapy (15)	Symptom scale (vocal, laryngeal, neurotic), capacity to relax self-evaluation scale	Combination of classical therapy with relaxation is effective
Sliwinska-K. 2002	Controlled trial	83 female teachers with chronic dysphonia	1) Logopedic treatment (47) 2) No intervention (36)	Symptom questionnaire, phoniatric examination, videostroboscopy	Logopedic voice therapy is effective

Table 02. Description of rating scales used

Instrument	Type	Scoring range	Number of items	Scaling method
Vocal Performance Questionnaire (Carding 1992)	Self-report	12 (best) - 60 (worst)	12	5-point Likert scale
Voice-Related Quality of Life (Hogikyan 1999)	Self-report	0 (worst) - 100 (best)	10	5-point Likert scale
Voice Symptom Severity Scale (Deary 2003)	Self-report	0 (best) - 150 (worst)	30	5-point Likert scale
Questionnaire about vocal symptoms (Simberg 2006)	Self-report	7 (worst) - 42 (best)	7	6-point Likert scale
GRBAS (Hirano 1989), GRBAS = Grade, Rough, Breathiness, Asthenic, Strain	Observer-rated	0 (best) - 100 (worst)	5	100 mm VAS
Overall severity scale (Carding 1999)	Observer-rated	1 (best) - 7 (worst)	1	7-point Likert scale
Buffalo Voice Profile (Wilson 1987)	Observer-rated	0 (best) - 5 (worst)	1	5-point Likert scale

Table 03. Assessment of study quality

Study ID	Randomisation method	Allocation concealed	Blinding	Attrition	Attr. differential?	Score
Beranova 2003	Method not reported	Unclear	N/A	Possibly two patients (11%) excluded or lost to follow up from entire sample	Yes	0/3
Carding 1999	Allocation in rotation	Inadequate	Adequate	None	No	2/4
Gillivan-Murphy 2005	Method not reported	Unclear	N/A	Four patients (20%) withdrew after randomisation	Yes	0/3

MacKenzie 2001	Computer generated random numbers	Adequate	Adequate	30 patients (30%) from the intervention group and 41 (39%) from the control group	No	4/4
Rattenbury 2004	Computer generated random numbers	Unclear	Adequate	None	No	3/4
Simberg 2006	Drawing lots from a hat	Inadequate	Adequate	None from the intervention group and 13 (39%) from the control group	Yes	1/4

Table 04. Search strategies

MEDLINE (PubMed)

#1 dysphoni*[tw] OR hoarseness[mh] OR phonastheni*[tw] OR trachyphoni*[tw] OR functional voice disorder*[tw] OR psychogenic voice disorder*[tw] OR ventricular phonation[tw] OR conversion voice disorder*[tw] OR functional aphonia[tw] OR conversion aphonia[tw] OR conversion dysphonia[tw] OR phonation break[tw] OR functional falsetto[tw] OR mutational falsetto[tw] OR puberphonia[tw] OR juvenile voice[tw] OR laryngeal myasthenia[tw]
#2 phonation[tw] NEAR (disease*[tw] OR disorder*)
#3 (voice[tw] OR vocal[tw] OR phonation[tw]) NEAR (problem*[tw] OR symptom*[tw] OR complaints[tw] OR hygiene[tw] OR disturbance*[tw] OR tremor*[tw] OR impair*[tw] OR handicap*[tw] OR tension*[tw] OR strain*[tw] OR abuse*[tw] OR fatigue*[tw] OR misuse*[tw] OR reduct*[tw])
#4 (randomized controlled trial[pt] OR controlled clinical trial[pt] OR randomized controlled trials[mh] OR random allocation[mh] OR double-blind method[mh] OR single-blind method[mh] OR clinical trial[pt] OR clinical trials[mh] OR "clinical trial"[tw] OR ((singl*[tw] OR doubl*[tw] OR trebl*[tw] OR tripl*[tw]) AND (mask*[tw] OR blind*[tw]))) OR "latin square"[tw] OR placebos[mh] OR placebo*[tw] OR random*[tw] OR research design[mh:noexp] OR comparative study[mh] OR evaluation studies[mh] OR follow-up studies[mh] OR prospective studies[mh] OR cross-over studies[mh] OR control*[tw] OR prospectiv*[tw] OR volunteer*[tw]) NOT (animal[mh] NOT human[mh])
#5 (effect*[tw] OR control*[tw] OR evaluation*[tw] OR protect*[tw]) NOT (animal[mh] NOT human[mh])
#6 (#1 OR #2 OR #3) AND (#4 OR #5)

EMBASE

#1 dysphonia/exp OR hoarseness/exp OR phonastheni* OR trachyphoni* OR "functional voice disorder*" OR "psychogenic voice disorder*" OR "ventricular phonation" OR "conversion voice disorder*" OR "functional aphonia" OR "conversion aphonia" OR "conversion dysphonia" OR "phonation break" OR "functional falsetto" OR "mutational falsetto" OR puberphonia OR "juvenile voice" OR "laryngeal myasthenia"
#2 phonation AND (disease* OR disorder*)
#3 (voice/exp OR vocal OR phonation) AND (problem* OR symptom* OR complaints OR hygiene/exp OR disturbance* OR tremor* OR impair* OR handicap* OR tension* OR strain* OR abuse* OR fatigue* OR misuse* OR reduct*)
#4 #1 OR #2 OR #3
#5 #4 AND [embase]/lim AND [article]/lim AND [human/]lim
#6 #5 AND [randomized controlled trial]/lim
#7 #5 AND [controlled clinical trial]/lim
#8 randomized controlled trial/exp OR clinical trial/exp OR double blind procedure/exp OR single blind procedure/exp OR (singl* OR doubl* OR trebl* OR tripl*) AND (mask* OR blind*) OR placebo/exp OR placebo* OR random* OR comparative study/exp OR "evaluation study" OR evaluation studies/exp OR follow up/exp OR prospective study/exp OR crossover procedure/exp OR prospectiv* OR volunteer*
#9 #5 AND #8
#10 #6 OR #7 OR #9

ANALYSES

Comparison 01. Any intervention vs. no intervention

Outcome title	No. of studies	No. of participants	Statistical method	Effect size
01 Primary (subjective) outcomes			Standardised Mean Difference (Random) 95% CI	Subtotals only
02 Secondary (objective) outcomes			Weighted Mean Difference (Fixed) 95% CI	Totals not selected

Comparison 02. Combined direct and indirect voice therapy vs. TFL-assisted treatment

Outcome title	No. of studies	No. of participants	Statistical method	Effect size
01 Vocal Performance Questionnaire			Weighted Mean Difference (Fixed) 95% CI	Totals not selected

COVER SHEET

Title	Interventions for treating functional dysphonia in adults
Authors	Ruotsalainen JH, Sellman J, Lehto L, Jauhiainen M, Verbeek JH
Contribution of author(s)	Jani Ruotsalainen conceptualised the review jointly with JV and took the lead in writing the protocol. Jos Verbeek conceptualised the review jointly with JR and wrote the methods section of the protocol. Merja Jauhiainen designed the systematic search strategies in collaboration with the Cochrane ENT Group's Trials Search Co-ordinator. Jaana Sellman and Laura Lehto wrote the second version of the protocol.
Issue protocol first published	2007/1
Review first published	2007/3
Date of most recent amendment	23 May 2007
Date of most recent SUBSTANTIVE amendment	22 May 2007
What's New	Information not supplied by author
Date new studies sought but none found	Information not supplied by author
Date new studies found but not yet included/excluded	Information not supplied by author
Date new studies found and included/excluded	Information not supplied by author
Date authors' conclusions section amended	Information not supplied by author
Contact address	Mr Jani Ruotsalainen Researcher Cochrane Occupational Health Field Finnish Institute of Occupational Health Neulaniementie 4

Kuopio
70701
FINLAND
E-mail: jani.ruotsalainen@ttl.fi
Tel: +358 30474 7334
Fax: +358 30474 7221

DOI 10.1002/14651858.CD006373.pub2
Cochrane Library number CD006373
Editorial group Cochrane Ear, Nose and Throat Disorders Group
Editorial group code HM-ENT

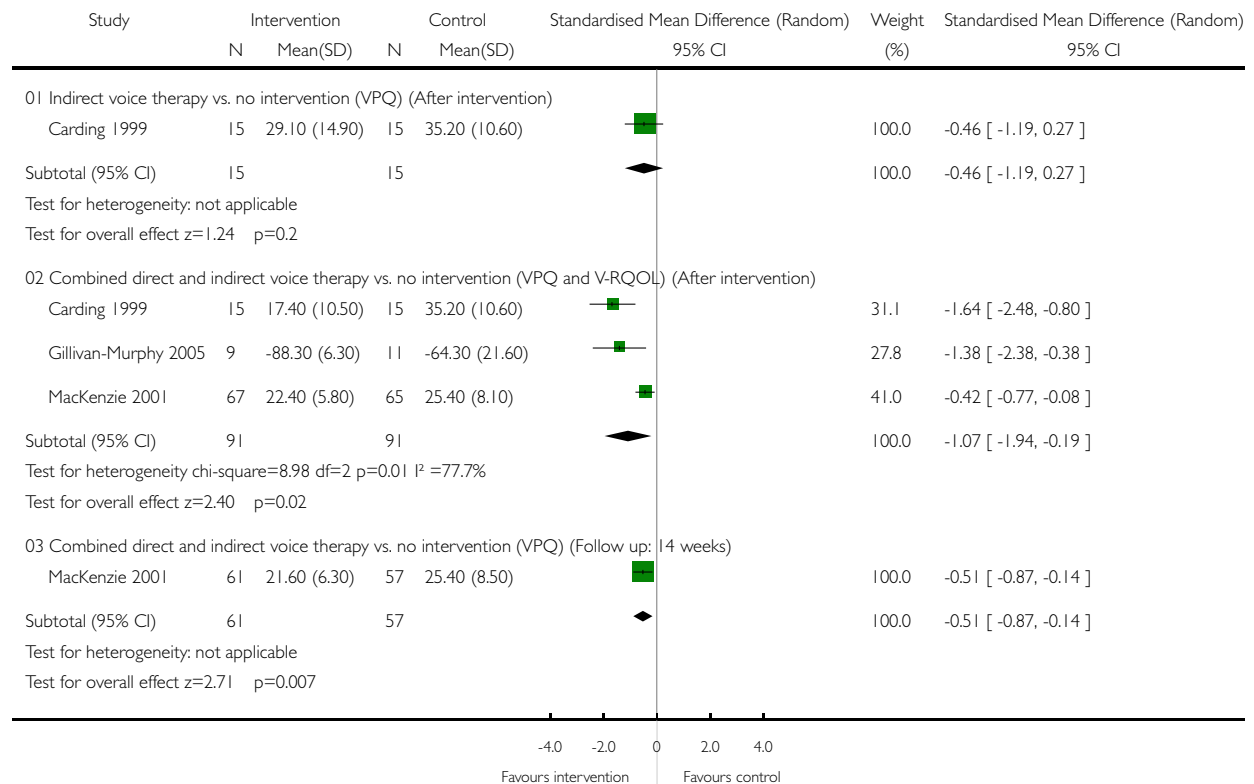
GRAPHS AND OTHER TABLES

Analysis 01.01. Comparison 01 Any intervention vs. no intervention, Outcome 01 Primary (subjective) outcomes

Review: Interventions for treating functional dysphonia in adults

Comparison: 01 Any intervention vs. no intervention

Outcome: 01 Primary (subjective) outcomes

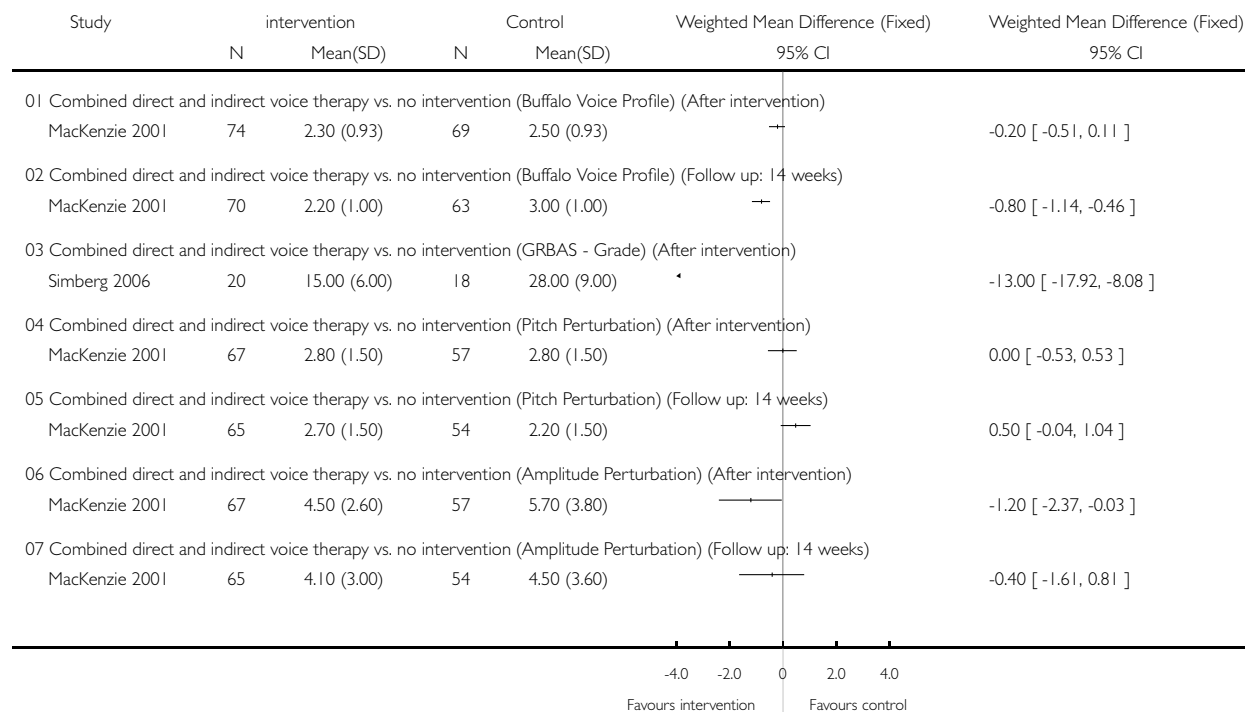


Analysis 01.02. Comparison 01 Any intervention vs. no intervention, Outcome 02 Secondary (objective) outcomes

Review: Interventions for treating functional dysphonia in adults

Comparison: 01 Any intervention vs. no intervention

Outcome: 02 Secondary (objective) outcomes



Analysis 02.01. Comparison 02 Combined direct and indirect voice therapy vs. TFL-assisted treatment, Outcome 01 Vocal Performance Questionnaire

Review: Interventions for treating functional dysphonia in adults

Comparison: 02 Combined direct and indirect voice therapy vs. TFL-assisted treatment

Outcome: 01 Vocal Performance Questionnaire

