Interventions for treating functional dysphonia in adults
(Review)

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

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

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 phoniatrist.

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 phoniatrist 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; Carding 2000). 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.

**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. phonogram, 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 aphony OR conversion aphony OR conversion dysphonia OR phonation break OR functional falsetto OR mutational falsetto OR pubertyphon 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**

---

Interventions for treating functional dysphonia in adults (Review)

Copyright © 2007 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd
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 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, coordination 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 a 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

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 Carding 1999) 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 included studies’):
(b) Controlled study but no work-directed intervention (Andrews 1986; García Real 2002; Mendoza-Lara 1990; Popovici 1993; Sliwinska-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 but 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
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-
tions 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 different 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 Sliwińska-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 Ver-\[dol\]in’s concept of phonotrauma. It adds greatly to the difficulty of comparing and combining studies when they are seemingly dealing with different issues.

A U T H O R S ’ C O N C L U S I O N S

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.

P O T E N T I A L C O N F L I C T O F I N T E R E S T

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

A C K N O W L E D G E M E N T S

Mari Qvärnström 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**

Berna nova 2003 (published data only)  

Carding 1999 (published data only)  

Gillivan-Murphy 2005 (published data only)  

MacKenzie 2001 (published data only)  

Rattenbury 2004 (published data only)  

Simberg 2006 (published data only)  

**References to studies excluded from this review**

Amir 2005  

Anderson 1998  

Andrews 1986  

Bassiony 1998  

Birkent 2004  

Bovo 2006  

Broadus-L. 2000  
Carding 1992

Carding 1998

Chan 1994

Duffy 2004

Fex 1994

Garcia Real 2002

Hollbrook 1974

John 2005

Jonsdottir 2001

Jonsdottir 2002

Kotby 1993

Laukkanen 2005

Lehto 2003

Lehto 2005

McCabe 2002

Mendoza-Lara 1990

Milbrath 2003

Motel 2003

Pedersen 2004

Popovici 1993

Prosek 1978

Roy 1993

Roy 1997

Roy 2001

Roy 2002

Roy 2003
Additional references

Aronson 1985  

Boone 1983  

Boone 1987  

Boone 1993  

Boone 2005  

Carding 2000  

Colton 2006  

Deary 2003  

Dejonckere 2001  

Enderby 1995  

Fawcus 1986  

Hartl 2005  

Hirano 1989  

Hogikyan 1999  

Jacobson 1999  

Jasper 2000  

Ma 2001  

Oates 2004  
Table 1: Characteristics of included studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Beranova 2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methods</td>
<td>Randomised controlled trial</td>
</tr>
<tr>
<td>Participants</td>
<td>16 consecutive patients with dysphonia persisting for more than two weeks</td>
</tr>
<tr>
<td>Interventions</td>
<td>1) Indirect treatment (9)</td>
</tr>
<tr>
<td></td>
<td>2) Pharmacotherapy (7)</td>
</tr>
<tr>
<td>Outcomes</td>
<td>1) Voice-Related Quality of Life</td>
</tr>
<tr>
<td></td>
<td>2) Videostroscopy; Phonotgram</td>
</tr>
</tbody>
</table>

Notes

Interventions for treating functional dysphonia in adults (Review)
### Characteristics of included studies (Continued)

<table>
<thead>
<tr>
<th>Study</th>
<th>Method</th>
<th>Participants</th>
<th>Interventions</th>
<th>Outcomes</th>
<th>Notes</th>
</tr>
</thead>
</table>
| Carding 1999         | Randomised controlled trial | 45 patients diagnosed with non-organic dysphonia | 1) Indirect treatment (15)  
2) Direct and indirect treatment (15)  
3) No intervention (15) | 1) Voice Performance Questionnaire  
2) Auditory voice quality ratings; Laryngoscopy; Laryngography; Fundamental Frequency analysis; Acoustic analysis | Allocation concealment D – Not used |
| Gillivan-Murphy 2005 | Randomised controlled trial | 20 teachers with self-reported voice/throat symptoms | 1) Direct and indirect treatment (10)  
2) No intervention (10) | 1) Voice-Related Quality of Life; Voice symptom scale  
2) Voice care knowledge VAS | Allocation concealment D – Not used |
| MacKenzie 2001       | Randomised controlled trial | 133 outpatients with persistent hoarseness for at least two months | 1) Direct and indirect treatment (70)  
2) No intervention (63) | 1) Vocal Performance Questionnaire  
2) Laryngeal rating; Buffalo Voice Profile; amplitude and pitch perturbation | Allocation concealment A – Adequate |
| Rattenbury 2004       | Randomised controlled trial | 50 consecutive patients with muscle tension dysphonia (MTD) | 1) Direct and indirect treatment (26)  
2) TFL-assisted voice therapy (24) | 1) Vocal Performance Questionnaire  
2) GRBAS; amplitude and pitch perturbation | 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

<table>
<thead>
<tr>
<th>Study</th>
<th>Reason for exclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amir 2005</td>
<td>ALLOCATION: Not randomised.</td>
</tr>
<tr>
<td>Birkent 2004</td>
<td>ALLOCATION: Not randomised.</td>
</tr>
<tr>
<td>Bovo 2006</td>
<td>ALLOCATION: Randomised. PARTICIPANTS: Included patients without any voice problems.</td>
</tr>
<tr>
<td>Carding 1992</td>
<td>ALLOCATION: Randomised. PARTICIPANTS: Included patients are in part the same individuals as in Carding 1999.</td>
</tr>
<tr>
<td>Carding 1998</td>
<td>ALLOCATION: Randomised. PARTICIPANTS: Included patients are in part the same individuals as in Carding 1999.</td>
</tr>
<tr>
<td>Chan 1994</td>
<td>ALLOCATION: Not randomised.</td>
</tr>
<tr>
<td>Duffy 2004</td>
<td>ALLOCATION: Randomised. PARTICIPANTS: Included patients without any voice problems.</td>
</tr>
<tr>
<td>Study</td>
<td>ALLOCATION</td>
</tr>
<tr>
<td>---------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Fex 1994</td>
<td>Not randomised</td>
</tr>
<tr>
<td>Garcia Real 2002</td>
<td>Not randomised</td>
</tr>
<tr>
<td>Holbrook 1974</td>
<td>Not randomised</td>
</tr>
<tr>
<td>John 2005</td>
<td>Not randomised</td>
</tr>
<tr>
<td>Jonsdottir 2001</td>
<td>Not randomised</td>
</tr>
<tr>
<td>Jonsdottir 2002</td>
<td>Not randomised</td>
</tr>
<tr>
<td>Kotby 1993</td>
<td>Not randomised</td>
</tr>
<tr>
<td>Laukkanen 2005</td>
<td>Not randomised</td>
</tr>
<tr>
<td>Lehto 2003</td>
<td>Not randomised</td>
</tr>
<tr>
<td>Lehto 2005</td>
<td>Not randomised</td>
</tr>
<tr>
<td>McCabe 2002</td>
<td>Not randomised</td>
</tr>
<tr>
<td>Mendoza-Lara 1990</td>
<td>Not randomised</td>
</tr>
<tr>
<td>Milbrath 2003</td>
<td>Not randomised</td>
</tr>
<tr>
<td>Motel 2003</td>
<td>Not randomised</td>
</tr>
<tr>
<td>Pedersen 2004</td>
<td>Randomised</td>
</tr>
<tr>
<td>Popovici 1993</td>
<td>Not randomised</td>
</tr>
<tr>
<td>Prosek 1978</td>
<td>Not randomised</td>
</tr>
<tr>
<td>Roy 1993</td>
<td>Not randomised</td>
</tr>
<tr>
<td>Roy 1997</td>
<td>Not randomised</td>
</tr>
<tr>
<td>Roy 2001</td>
<td>Randomised</td>
</tr>
<tr>
<td>Roy 2002</td>
<td>Randomised</td>
</tr>
</tbody>
</table>

**PARTICIPANTS:** Included patients are the same individuals as in Beranova 2003. The two articles are identical apart from language.

**PARTICIPANTS:** Included patients without a diagnosis of functional dysphonia.
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

<table>
<thead>
<tr>
<th>Study ID</th>
<th>Methods</th>
<th>Participants</th>
<th>Interventions</th>
<th>Outcomes</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andrews 1986</td>
<td>Controlled trial</td>
<td>10 female subjects matched based on age and dysphonia severity</td>
<td>1) EMG biofeedback training (5) 2) Progressive relaxation training (5)</td>
<td>Laryngeal muscle tension, control of vocal fold vibration, auditory evaluation, personality measures, self-rating of voice, laryngoscopy</td>
<td>Both interventions effective; no significant difference between groups.</td>
</tr>
<tr>
<td>Garcia Real 2002</td>
<td>Controlled trial</td>
<td>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</td>
<td>1) Hydration treatment (27) 2) Hydration and direct treatment (25) 3) No intervention (23)</td>
<td>Laryngoscopy, maximum phonation time, speaking time and fundamental frequency</td>
<td>Both interventions effective; no significant difference between groups.</td>
</tr>
<tr>
<td>Mendoza-Lara 1990</td>
<td>Controlled trial</td>
<td>14 dysphonic</td>
<td>1) Traditional</td>
<td>Auditory voice</td>
<td>Both interventions</td>
</tr>
</tbody>
</table>
### Table 01. Controlled (Non-randomised) Trials (Continued)

<table>
<thead>
<tr>
<th>Study ID</th>
<th>Methods</th>
<th>Participants</th>
<th>Interventions</th>
<th>Outcomes</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Popovici 1993</td>
<td>Controlled trial</td>
<td>39 patients suffering from psychosomatic or conversive voice problems</td>
<td>1) Classical therapy and relaxation (24) 2) Classical therapy (15)</td>
<td>Symptom scale (vocal, laryngeal, neurotic), capacity to relax self-evaluation scale</td>
<td>Combination of classical therapy with relaxation is effective</td>
</tr>
<tr>
<td>Sliwinska-K. 2002</td>
<td>Controlled trial</td>
<td>83 female teachers with chronic dysphonia</td>
<td>1) Logopedic treatment (47) 2) No intervention (36)</td>
<td>Symptom questionnaire, phoniatric examination, videostroscopy</td>
<td>Logopedic voice therapy is effective</td>
</tr>
</tbody>
</table>

### Table 02. Description of rating scales used

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

### Table 03. Assessment of study quality

<table>
<thead>
<tr>
<th>Study ID</th>
<th>Randomisation method</th>
<th>Allocation concealed</th>
<th>Blinding</th>
<th>Attrition</th>
<th>Attr. differential?</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beranova 2003</td>
<td>Method not reported</td>
<td>Unclear</td>
<td>N/A</td>
<td>Possibly two patients (11%) excluded or lost to follow up from entire sample</td>
<td>Yes</td>
<td>0/3</td>
</tr>
<tr>
<td>Carding 1999</td>
<td>Allocation in rotation</td>
<td>Inadequate</td>
<td>Adequate</td>
<td>None</td>
<td>No</td>
<td>2/4</td>
</tr>
<tr>
<td>Gillivan-Murphy 2005</td>
<td>Method not reported</td>
<td>Unclear</td>
<td>N/A</td>
<td>Four patients (20%) withdrew after randomisation</td>
<td>Yes</td>
<td>0/3</td>
</tr>
</tbody>
</table>
MacKenzie 2001 Computer generated random numbers Adequate Adequate 30 patients (30%) from the intervention group and 41 (39%) from the control group

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

Table 04. Search strategies

**MEDLINE (PubMed)**


#2 phonation*[tw] NEAR (disease*[tw] OR disorder*)


#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 trachypnoi* OR “functional voice disorder”* OR “psychogenic voice disorder”* OR “ventricular phonation” OR “conversion voice disorder”* OR “functional aphonya” OR “conversion aphonya” OR “conversion dysphasia” 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 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

<table>
<thead>
<tr>
<th>Outcome title</th>
<th>No. of studies</th>
<th>No. of participants</th>
<th>Statistical method</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 Primary (subjective) outcomes</td>
<td></td>
<td></td>
<td>Standardised Mean Difference (Random) 95% CI</td>
<td>Subtotals only</td>
</tr>
<tr>
<td>02 Secondary (objective) outcomes</td>
<td></td>
<td></td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>Totals not selected</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Outcome title</th>
<th>No. of studies</th>
<th>No. of participants</th>
<th>Statistical method</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 Vocal Performance Questionnaire</td>
<td></td>
<td></td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>Totals not selected</td>
</tr>
</tbody>
</table>

### 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
### 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

<table>
<thead>
<tr>
<th>Study</th>
<th>Intervention</th>
<th>Control</th>
<th>Standardised Mean Difference (Random)</th>
<th>Weight (%)</th>
<th>Standardised Mean Difference (Random)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean(SD)</td>
<td>N</td>
<td>Mean(SD)</td>
<td>95% CI</td>
</tr>
<tr>
<td>01 Indirect voice therapy vs. no intervention (VPQ) (After intervention)</td>
<td>Carding 1999</td>
<td>15</td>
<td>29.10 (14.90)</td>
<td>15</td>
<td>35.20 (10.60)</td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>15</td>
<td>15</td>
<td>100.0</td>
<td>100.0</td>
<td>-0.46 [ -1.19, 0.27 ]</td>
</tr>
</tbody>
</table>
| Test for heterogeneity: not applicable  
| Test for overall effect z=1.24 p=0.2 |
| 02 Combined direct and indirect voice therapy vs. no intervention (VPQ and V-RQOL) (After intervention) | Carding 1999 | 15 | 17.40 (10.50) | 15 | 35.20 (10.60) | -1.64 [ -2.48, -0.80 ] | 31.1 | -1.64 [ -2.48, -0.80 ] |
| Gillivan-Murphy 2005 | 9 | -88.30 (6.30) | 11 | -64.30 (21.60) | -1.38 [ -2.38, -0.38 ] | 27.8 | -1.38 [ -2.38, -0.38 ] |
| MacKenzie 2001 | 67 | 22.40 (5.80) | 65 | 25.40 (8.10) | -0.42 [ -0.77, -0.08 ] | 41.0 | -0.42 [ -0.77, -0.08 ] |
| Subtotal (95% CI) | 91 | 91 | 100.0 | 100.0 | -1.07 [ -1.94, -0.19 ] |  
| Test for heterogeneity chi-square=8.98 df=2 p=0.01 I² =77.7%  
| Test for overall effect z=2.40 p=0.02 |
| 03 Combined direct and indirect voice therapy vs. no intervention (VPQ) (Follow up: 14 weeks) | MacKenzie 2001 | 61 | 21.60 (6.30) | 57 | 25.40 (8.50) | -0.51 [ -0.87, -0.14 ] | 100.0 | -0.51 [ -0.87, -0.14 ] |
| Subtotal (95% CI) | 61 | 57 | 100.0 | 100.0 | -0.51 [ -0.87, -0.14 ] |  
| Test for heterogeneity: not applicable  
| Test for overall effect z=2.71 p=0.007 |
### Analysis 01.02. Comparison 01 Any intervention vs. no intervention, Outcome 02 Secondary (objective) outcomes

**Review:** Interventions for treating functional dysphonia in adults  
**Comparison:** Any intervention vs. no intervention  
**Outcome:** Secondary (objective) outcomes

<table>
<thead>
<tr>
<th>Study Intervention</th>
<th>Control</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Mean(SD)</td>
<td>N</td>
<td>Mean(SD)</td>
</tr>
<tr>
<td>01 Combined direct and indirect voice therapy vs. no intervention (Buffalo Voice Profile) (After intervention)</td>
<td>74</td>
<td>2.30 (0.93)</td>
<td>69</td>
</tr>
<tr>
<td>MacKenzie 2001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>02 Combined direct and indirect voice therapy vs. no intervention (Buffalo Voice Profile) (Follow up: 14 weeks)</td>
<td>70</td>
<td>2.20 (1.00)</td>
<td>63</td>
</tr>
<tr>
<td>MacKenzie 2001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>03 Combined direct and indirect voice therapy vs. no intervention (GRBAS - Grade) (After intervention)</td>
<td>20</td>
<td>15.00 (6.00)</td>
<td>18</td>
</tr>
<tr>
<td>Simberg 2006</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>04 Combined direct and indirect voice therapy vs. no intervention (Pitch Perturbation) (After intervention)</td>
<td>67</td>
<td>2.80 (1.50)</td>
<td>57</td>
</tr>
<tr>
<td>MacKenzie 2001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>05 Combined direct and indirect voice therapy vs. no intervention (Pitch Perturbation) (Follow up: 14 weeks)</td>
<td>65</td>
<td>2.70 (1.50)</td>
<td>54</td>
</tr>
<tr>
<td>MacKenzie 2001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>06 Combined direct and indirect voice therapy vs. no intervention (Amplitude Perturbation) (After intervention)</td>
<td>67</td>
<td>4.50 (2.60)</td>
<td>57</td>
</tr>
<tr>
<td>MacKenzie 2001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07 Combined direct and indirect voice therapy vs. no intervention (Amplitude Perturbation) (Follow up: 14 weeks)</td>
<td>65</td>
<td>4.10 (3.00)</td>
<td>54</td>
</tr>
<tr>
<td>MacKenzie 2001</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 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:** Combined direct and indirect voice therapy vs. TFL-assisted treatment  
**Outcome:** Vocal Performance Questionnaire

<table>
<thead>
<tr>
<th>Study</th>
<th>TFL-assisted</th>
<th>Traditional</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Mean(SD)</td>
<td>N</td>
<td>Mean(SD)</td>
<td>95% CI</td>
</tr>
<tr>
<td>Rattenbury 2004</td>
<td>24</td>
<td>20.10 (6.50)</td>
<td>25</td>
<td>17.70 (4.60)</td>
</tr>
</tbody>
</table>

---

Interventions for treating functional dysphonia in adults (Review)

Copyright © 2007 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd