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Lifestyle modification for obstructive sleep apnoea (Review)

Shneerson J, Wright JJ

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[Intervention Review]

Lifestyle modification for obstructive sleep apnoea

John Shneerson[1], John J Wright[2]

[1]Respiratory Support and Sleep Centre, Papworth Hospital, Cambridge, UK. [2]Bradford Institute for Health Research, Bradford Royal Infirmary, Bradford, UK

Contact address: John Shneerson, Respiratory Support and Sleep Centre, Papworth Hospital, Papworth Everard, Cambridge, CB3 8RE, UK. john.shneerson@papworth.nhs.uk.

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ABSTRACT

Background

Obstructive sleep apnoeas are due to transient closure of the upper airway during sleep and merge into hypopnoeas in which the airway narrows, but some airflow continues. They are due to the forces compressing the airway overcoming those which stabilise its patency. The commonest association is obesity in which fatty tissue is deposited around the airway. Exercise has been recommended as a method of losing weight, but other techniques which achieve this are also thought to improve symptoms due to sleep apnoeas. Sleep hygiene may alter the sleep structure and the control of the upper airway during sleep and thus promote its patency.

Objectives

The objectives of this review are to determine whether weight loss, sleep hygiene and exercise are effective in the treatment of obstructive sleep apnoeas.

Search methods

The Cochrane Airways Group Specialised Register, CENTRAL, MEDLINE, EMBASE, CINAHL and reference lists of review articles have been searched. The date of the last search was April 2009.

Selection criteria

Randomised, single or double blind placebo controlled, either parallel group or crossover design studies of any of these interventions were to have been included.

Data collection and analysis

No completed trials have been identified.

Main results

No randomised trial data were available for analysis. An update search has identified a study presented in abstract form only. The findings from one additional ongoing study are awaited.

Authors' conclusions

There is a need for randomised controlled trials of these commonly used treatments in obstructive sleep apnoeas. These should identify which sub groups of patients with sleep apnoeas benefit most from each type of treatment and they should have clear and standardised outcome measures.

PLAIN LANGUAGE SUMMARY

Lifestyle modification strategies for managing obstructive sleep apnoea

Obstructive sleep apnoea happens when breathing is either stopped or reduced during sleep because of a narrowing or blockage of the upper airway (passage to the lungs). It causes loud snoring and occasional apnoea (stopping breathing). It can lead to daytime sleepiness and may cause, hypertension, stroke and road accidents. Lifestyle modification, especially weight loss, sleep hygiene and exercise, are often recommended. These could help by relieving pressure on the upper airway, and increasing muscle tone in the airway. However, the review found no trials to assess the effects of these strategies, and more research is needed.

BACKGROUND

Obstructive sleep apnoeas are due to transient closure of the upper airway during sleep and are conventionally defined when airflow ceases for more than ten seconds. The patency of the upper airway depends on the balance of forces across it and on its compliance. Any factor which narrows the upper airway, increases the pressure around it, reduces the pressure within it, or increases its compliance, will predispose towards sleep apnoeas. The most important causes are a small initial size of the upper airway, loss of upper airway dilator muscle activity and an increase in inspiratory chest wall muscle activity. Sleep deprivation reduces the respiratory drive to both hypoxia and hypercapnia which tends to prolong the apnoeas, increases the threshold for arousal and alters the sleep architecture. (Guilleminault 1981 and White 1983)

The commonest cause of a small upper airway is obesity. The adipose tissue which is deposited within the neck surrounds the airway and mass loads this, tending to collapse it when the dilator muscle tone is reduced (Davies 1992, Stradling 1991).

The adverse effects of sleep apnoeas are partially due to fragmentation of the sleep structure and partly due to the cardiorespiratory consequences. The arousals at the end of each apnoea break the continuity of sleep and lead to daytime sleepiness and other neuropsychological effects with an increased risk of road traffic accidents. The oxygen desaturation changes and intrapleural pressure swings cause cardiac dysrhythmias and surges of blood pressure during the apnoeas and may be linked to the increased risk of stroke, myocardial infarction and daytime hypertension that has been demonstrated in those with obstructive sleep apnoeas.

Conservative treatment is usually the first line of management for sleep apnoeas unless they are severe and frequent both with a view to relieving symptoms and avoiding the complications of the apnoeas. Weight loss has been recommended on the basis that it should decompress the upper airway and promote its patency, particularly if weight gain has coincided with worsening of the symptoms or of the sleep study findings. Uncontrolled studies have suggested that it may be effective (Lojander 1998, Noseda 1996, Smith 1985). Exercise is primarily recommended in order to lose weight, but may also alter the sleep structure.

Other life style modifications are designed to improve 'sleep hygiene'. These include measures to improve the sleep environment so the bed is comfortable and the bedroom warm, quiet and dark, avoiding caffeinated drinks in the evening and other stimulants, improving the sleep/wake patterns by, for instance, increasing physical activity during the day, preparation for sleep by mentally winding down in the evenings and avoiding daytime naps. Avoidance of excessive alcohol in the evening is important (Issa 1982, Scrima 1982). There have been few studies of sleep hygiene (Redline 1998), but sleep deprivation has been shown to increase the collapsibility of the upper airway (Series 1994). The value of these first line measures has not been established. It remains uncertain how effective they are in reducing symptoms and, if they are effective, whether the benefit is sustained.

OBJECTIVES

The objectives of this review are to determine whether weight loss, sleep hygiene and exercise are effective in the treatment of obstructive sleep apnoeas in reducing symptoms and whether any benefits are maintained.

METHODS

Criteria for considering studies for this review

Types of studies

Studies selected for this review will be randomised, either single or double blind, placebo controlled and of either parallel group or cross over design.

Types of participants

Participants will be of any age and either sex with stable obstructive sleep apnoeas diagnosed by sleep studies and with an apnoea hypopnoea index or respiratory disturbance index or similar score of greater than 5 per hour. Patients should not be using nasal continuous positive airway pressure (CPAP) systems, mandibular advancement devices or have previously undergone upper airway surgery for snoring or sleep apnoeas. Studies including subjects with chronic obstructive pulmonary disease (COPD), neuro-muscular disorders and heart failure were excluded.

Types of interventions

Participants will be randomised to either placebo or weight loss, sleep hygiene or exercise programmes. Co-interventions such as surgery will be recorded and where possible will provide a basis for subgroup comparisons.

Types of outcome measures

Primary outcome measures included:
1. Excessive daytime sleepiness using a validated and reliable symptom score scale e.g. Epworth Sleepiness Scale or other technique, e.g. multiple sleep latency test (MSLT)
2. Apnoea - Hypopnoeas Index (AHI), desaturation index or equivalent scoring system
3. Severity of snoring
4. Cognitive outcome scores
5. Quality of life using a recognised scale
6. Survival

Search methods for identification of studies

Electronic searches

The Cochrane Airways Group Specialised Register of trials was initially searched in July 2000 together with a CENTRAL, MEDLINE, EMBASE and CINAHL search. Subsequent search updates have been run on the Register. The most recent search was carried out in April 2009.

The Cochrane Airways Group Specialised Register of trials is derived from systematic searches of bibliographic databases including the Cochrane Central Register of Controlled Trials (CENTRAL), MEDLINE, EMBASE, CINAHL, AMED and PsycINFO, and handsearching of respiratory journals and meeting abstracts (please see the Airways Group Module for further details). All records in the Specialised Register coded as 'sleep apnea' were searched using the following terms:

(Weight* or exerc* or smok* or nicotine or cannabis or coffee or caffein* or *caffein or alcohol* or diet*) or (depriv* or restrict* or hygien* and (sleep))

Searching other sources

Reference lists from review articles were also searched. There was no restriction on language of publication.

Data collection and analysis

METHODS OF REVIEW

a) Selection of trials

The titles and abstracts were reviewed to assess which references were relevant for this review. The full text of selected papers was then assessed for inclusion, based on the types of participant, the study design, types of intervention and outcome measures.

b) Quality Assessment

Studies that have been included have been subjected to quality assessment using the Cochrane approach. For the 2008 update this was expanded to include an assessment of the risk of bias in eligible trials.

c) Data Extraction

Data will be extracted from published selected studies and entered into the Cochrane Collaboration Software programme, Review Manager 4.0. Data in table or graphic form will be used if published and authors will be requested to provide clarification and additional information for the review. Any disagreement will be resolved by an independent adjudicator.

RESULTS

Description of studies

For details of search history see Table 1.

One study presented in abstract form awaits assessment pending availability of study characteristics and findings (Ahari 2005). Correspondence with the study investigator confirmed that the trial will be submitted for publication in 2006. As of April 2008, this was not available.

No other randomised control trials were identified which meet the inclusion criteria.

Risk of bias in included studies

No studies could be included in the analysis of this review.

Effects of interventions

No results from randomised trials meeting the inclusion criteria could be analysed.

DISCUSSION

A comprehensive search strategy was used for this review and every effort was made to identify all relevant studies. None were excluded because of the language of the publication, but it remains possible that some references have not been identified. Most of the studies were descriptive. They had very variable entry criteria as regards the definition and severity of obstructive sleep apnoeas and a variety of outcome criteria. These included subjective assessments such as daytime sleepiness and physiological measurements. The length of follow-up varied considerably between the studies.

This review indicates that there is a lack of randomised controlled trial data with regard to the effectiveness of weight loss, exercise and sleep hygiene techniques in the treatment of obstructive sleep apnoeas. This is particularly important because of the frequency with which these measures are recommended for this common condition (SIGN 2003). One unpublished, ongoing study has been identified (Ahari 2005). Future versions of this review will incorporate findings from this study.

AUTHORS' CONCLUSIONS

Implications for practice

There is no evidence that simple non-invasive lifestyle changes may improve sleep apnoea or its consequences. These measures may nevertheless be tried, particularly in the obese or those with very poor sleep hygiene since they are non-invasive. Lack of benefit from these approaches should not preclude the patient from progressing to other treatments which have been shown to be effective, such as nasal continuous positive airway pressure (CPAP).

Implications for research

There is a need for randomised controlled trials of the effects of weight loss, exercise and sleep hygiene in the treatment of obstructive sleep apnoea. Care should be taken in the definition of this disorder and to ensure that the outcome measures are as objective and standardised as possible to ensure comparability between studies.

ACKNOWLEDGEMENTS

I am grateful to members of the Cochrane Airways Group especially Steven Milan and to Dr John Wright for their help. Many thanks to Dr JC Meurice for corresponding with regard to Ahari 2005.

REFERENCES

References to studies excluded from this review

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Davila DG, Hurt RD, Offord KP, Harris CD, Shepard JW. Acute effects of transdermal nicotine on sleep architecture, snoring, and sleep-disordered breathing in nonsmokers. *American Journal of Respiratory & Critical Care Medicine* 1994;**150**:469-74.

Ferini-Strambi 1991 *{published data only}*

Ferini-Strambi L, Franceschi M, Cattaneo AG, Smirne S, Calori G, Caviezel F. Sleep-related growth hormone secretion in human obesity: effect of dietary treatment. *Neuroendocrinology* 1991;**54**:412-5.

Gillin 1994 *{published data only}*

Gillin JC, Lardon M, Ruiz C, Golshan S, Salin-Pascual R. Dose-dependent effects of transdermal nicotine on early morning awakening and rapid eye movement sleep time in nonsmoking normal volunteers. *Journal of Clinical Psychopharmacology* 1994;**14**:264-7.

Jokic 1999 *{published data only}*

Jokic R, Klimaszewski A, Crossley M, Sridhar G, Fitzpatrick MF. Positional treatment vs continuous positive airway pressure in patients with positional obstructive sleep apnea syndrome. *Chest* 1999;**115**:771-81.

Kajaste 2004 *{published data only}*

Kajaste S, Brander PE, Telakivi T, Partinen M, Mustajoki P. A cognitive-behavioral weight reduction program in the treatment of obstructive sleep apnea syndrome with or without initial nasal CPAP: A randomized study. *Sleep Medicine* 2004;**5**(2):125-31.

Mitler 1997 *{published data only}*

Mitler MM, Miller JC, Lipsitz JJ, Walsh JK, Wylie CD. The sleep of long-haul truck drivers. *New England Journal of Medicine* 1997;**337**:755-61.

Petersen 2003 *{published data only}*

Petersen MC, Qvist J. Weight loss in obese patients with severe OSAS decreases neck circumference and lowers level of CPAP pressure - a trial of dietary intervention with or without lipase inhibition therapy [Abstract]. *Sleep Medicine* 2003;**4**(Suppl 1):S36.

Sampol 1998 *{published data only}*

Sampol G, Munoz X, Sagales MT, Marti S, Roca A, Dolors de la Calzada M, et al. Long-term efficacy of dietary weight loss in sleep apnoea/hypopnoea syndrome. *European Respiratory Journal* 1998;**12**:1156-9.

Schmidt 1983 *{published data only}*

Schmidt HS. L-Tryptophan in the treatment of impaired respiration in sleep. *Bulletin Europeen de Physiopathologie Respiratoire* 1983;**19**:625-9.

Suratt 1992 *{published data only}*

Suratt PM, McTier RF, Findley LJ, Pohl SL, Wilhoit SC. Effect of very-low-calorie diets with weight loss on obstructive sleep apnea. *American Journal of Clinical Nutrition* 1992;**56**:182S-4S.

Watson 1992 *{published data only}*

Watson RK, Thompson AS. Treatment outcome of sleep apnea. *Connecticut Medicine* 1992;**56**:125-9.

Wirth 1995 *{published data only}*

Wirth JA. Organic psychosyndrome and sleep apnea. Transdermal nicotine--a new therapy concept? [Hirnorganisches Psychosyndrom und Schlafapnoe Transdermales Nikotin - ein neues Therapiekonzept?]. *Pneumologie* 1995;**49**(Suppl 1):183-4.

References to studies awaiting assessment

Ahari 2005 *{published data only}*

Ahari V, Ingrand P, Paquereau J, levrat V, Neau JP, Pinon B, et al. Effects of a very low-calorie diet-induced weight loss in the treatment of obstructive sleep apnea syndrome [Abstract]. American Thoracic Society International Conference; May 20-25; San Diego, California. 2005:A63, Poster B2.

Habdank 2006 *{unpublished data only}*

Habdank K, Paul T, Sen M, Ferguson A. A randomized controlled trial evaluating the effectiveness of a weight loss strategy in overweight and obese patients with obstructive sleep apnea (OSA). *Sleep Medicine* 2006;**7**:S73.

Habdank KM, Paul TL, Sen M, Ferguson KA. Randomized controlled trial evaluating the effectiveness of a weight loss strategy in overweight patients with obstructive sleep apnea. Proceedings of the American Thoracic Society. 2006:A868.

Svendsen 2007 *{published data only}*

Svendsen M, Blomhoff R, Holme I, Tonstad S. The effect of an increased intake of vegetables and fruit on weight loss, blood pressure and antioxidant defense in subjects with sleep related breathing disorders. *European Journal of Clinical Nutrition* 2007;**61**(11):1301-11.

Tuomilehto 2006 *{published data only}*

Tuomilehto H, Seppa J, Sahlman J. Weight reduction and life style intervention as a treatment of mild OSAS - a prospective and randomized study. *Sleep Medicine* 2006;**7**:S48.

Tuomilehto H, Seppa J, Sahlman J, Partinen M. Weight reduction and lifestyle intervention as a treatment of mild obstructive sleep apnea (OSA). *European Archives of Oto-Rhino-Laryngology and Head & Neck* 2007;**264**(Suppl 1):S65.

Vasquez 2007 *{published data only}*

Vasquez M, Goodwin J, Drescher A, Smith T, Simon R, Quan S. Associations of dietary intake and physical activity with sleep disordered breathing. *Sleep* 2007;**30**(Suppl):A174.

References to ongoing studies

Foster 2001 *{published data only}*

Foster GD. Sleep Apnea in Look AHEAD Participants. CRISP 2001.

Additional references

Davies 1992

Davies RJ, Ali NJ, Stradling JR. Neck circumference and other clinical features in the diagnosis of the obstructive sleep apnoea syndrome. *Thorax* 1992;**47**:101-5.

Guilleminault 1981

Guilleminault C, Rosekind M. The arousal threshold: sleep deprivation, sleep fragmentation, and obstructive sleep apnea syndrome. *Bulletin Europeen de Physiopathologie Respiratoire* 1981;**17**:341-9.

Issa 1982

Issa FG, Sullivan CE. Alcohol, snoring and sleep apnea. *Journal of Neurology, Neurosurgery & Psychiatry* 1982;**45**:353-9.

Lojander 1998

Lojander J, Mustajoki P, Ronka S, Mecklin P, Maasilta P. A nurse-managed weight reduction programme for obstructive sleep apnoea syndrome. *Journal of Internal Medicine* 1998;**244**:251-5.

Noseda 1996

Noseda A, Kempenaers C, Kerkhofs M, Houben JJ, Linkowski P. Sleep apnea after 1 year domiciliary nasal-continuous positive airway pressure and attempted weight reduction. *Chest* 1996;**109**:138-43.

Redline 1998

Redline S, Adams N, Strauss ME, Roebuck T, Winters M, Rosenberg C. Improvement of mild sleep-disordered breathing with CPAP compared with conservative therapy. *American Journal of Respiratory & Critical Care Medicine* 1998;**157**:858-65.

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Scrima L, Broudy M, Nay KN, Cohn MA. Increased severity of obstructive sleep apnea after bedtime alcohol ingestion: diagnostic potential and proposed mechanism of action. *Sleep* 1982;**5**:318-28.

Series 1994

Series F, Roy N, Marc I. Effects of sleep deprivation and sleep fragmentation on upper airway collapsibility in normal subjects. *American Journal of Respiratory & Critical Care Medicine* 1994;**150**:481-5.

SIGN 2003

Scottish Intercollegiate Guideline Network. Management of obstructive sleep apnoea/hypopnoea syndrome in adults (guideline no. 73). www.sign.ac.uk 2003.

Smith 1985

Smith PL, Gold AR, Meyers DA, Haponik EF, Bleecker ER. Weight loss in mildly to moderately obese patients with obstructive sleep apnea. *Annals of Internal Medicine* 1985;**103**:850-5.

Stradling 1991

Stradling JR, Crosby JH. Predictors and prevalence of obstructive sleep apnoea and snoring in 1001 middle aged men. *Thorax* 1991;**46**:85-90.

White 1983

White DP, Douglas NJ, Pickett CK, Weil JV, Zwillich CW. Sleep deprivation and the control of breathing. *American Review of Respiratory Disease* 1983;**128**:984-6.

CHARACTERISTICS OF STUDIES

Characteristics of excluded studies *[ordered by study ID]*

Study	Reason for exclusion
Davila 1994	Study looked at healthy subjects
Ferini-Strambi 1991	Not a RCT
Gillin 1994	Study looked at healthy subjects
Jokic 1999	No untreated control group
Kajaste 2004	All participants underwent weight-loss programme prior to randomisation between CPAP and non-CPAP control groups.
Mitler 1997	Not a RCT
Petersen 2003	RCT between lipase inhibitor and placebo following weight loss programme undergone by all study participants (all participants also on either CPAP or BiPAP).

Study	Reason for exclusion
Sampol 1998	Not a RCT
Schmidt 1983	Study focused on drug treatment rather than lifestyle modification
Suratt 1992	Not a RCT
Watson 1992	Not a RCT
Wirth 1995	Not a RCT

Characteristics of ongoing studies *[ordered by study ID]*

Foster 2001

Trial name or title	Look AHEAD
Methods	
Participants	120 participants with diabetes and OSA (RDI greater than 15)
Interventions	Weight loss programme or usual care
Outcomes	Weight; home PSG
Starting date	2001
Contact information	fosterg@mail.med.upenn.edu
Notes	

PSG - Polysomnography; OSA: Obstructive sleep apnoea; RDI: Respiratory disturbance index

ADDITIONAL TABLES

Table 1. Search history

Years	Detail
All years to April 2004	References identified: 316 References excluded on the basis of abstract/title: 295 References retrieved as full-text articles: 21 Studies awaiting assessment: 0 Ongoing studies: 0 Studies excluded: 21 Studies meeting review inclusion criteria: 0
April 2004-April 2005	References identified: 22 References excluded on the basis of abstract/title: 19 References retrieved as full-text articles: 3 Studies awaiting assessment: 0 Ongoing studies: 1 Studies excluded: 2

Table 1. Search history *(Continued)*

	Studies meeting review inclusion criteria: 0
April 2005-April 2006	References identified: 12 References excluded on the basis of abstract/title: 11 References retrieved as full-text articles: 1 Studies awaiting assessment: 1 Ongoing studies: 0 Studies excluded: 0 Studies meeting review inclusion criteria: 0

WHAT'S NEW

Date	Event	Description
8 April 2009	New search has been performed	Literature search re-run; no new studies found.

HISTORY

Protocol first published: Issue 1, 2000
Review first published: Issue 1, 2001

Date	Event	Description
11 September 2008	New search has been performed	Literature search re-run; no new studies identified.
7 April 2008	Amended	Converted to new review format.
29 September 2000	New citation required and conclusions have changed	Substantive amendment

DECLARATIONS OF INTEREST

We can confirm that we have not been in receipt of any benefit in cash or kind, any hospitality or any subsidy derived from any source that may or may be perceived to have an interest in the outcome of the review.

SOURCES OF SUPPORT

Internal sources

- NHS Research and Development, UK.

External sources

- No sources of support supplied

INDEX TERMS

Medical Subject Headings (MeSH)

*Exercise; *Life Style; *Weight Loss; Randomized Controlled Trials as Topic; Sleep Apnea, Obstructive [*therapy]

MeSH check words

Humans