Didgeridoo playing as alternative treatment for obstructive sleep apnoea syndrome: randomised controlled trial

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Abstract

Objective To assess the effects of didgeridoo playing on daytime sleepiness and other outcomes related to sleep by reducing collapsibility of the upper airways in patients with moderate obstructive sleep apnoea syndrome and snoring.

Design Randomised controlled trial.

Setting Private practice of a didgeridoo instructor and a single centre for sleep medicine.

Participants 25 patients aged >18 years with an apnoea-hypopnoea index between 15 and 30 and who complained about snoring.

Interventions Didgeridoo lessons and daily practice at home with standardised instruments for four months. Participants in the control group remained on the waiting list for lessons.

Main outcome measure Daytime sleepiness (Epworth scale from 0 (no daytime sleepiness) to 24), sleep quality (Pittsburgh quality of sleep index from 0 (excellent sleep quality) to 21), partner rating of sleep disturbance (visual analogue scale from 0 (not disturbed) to 10), apnoea-hypopnoea index, and health related quality of life (SF-36).

Results Participants in the didgeridoo group practised an average of 5.9 days a week (SD 0.86) for 25.3 minutes (SD 3.4). Compared with the control group in the didgeridoo group daytime sleepiness (difference −3.0, 95% confidence interval −5.7 to −0.3, $P = 0.03$) and apnoea-hypopnoea index (difference −6.2, −12.3 to −0.1, $P = 0.05$) improved significantly and partners reported less sleep disturbance (difference −2.8, −4.7 to −0.9, $P < 0.01$). There was no effect on the quality of sleep (difference −0.7, −2.1 to 0.6, $P = 0.27$). The combined analysis of sleep related outcomes showed a moderate to large effect of didgeridoo playing (difference between summary z scores −0.78 SD units, −1.27 to −0.28, $P < 0.01$). Changes in health related quality of life did not differ between groups.

Conclusion Regular didgeridoo playing is an effective treatment alternative well accepted by patients with moderate obstructive sleep apnoea syndrome.

Trial registration ISRCTN: 31571714.

Introduction

The most effective intervention for snoring and obstructive sleep apnoea syndrome is continuous positive airway pressure (CPAP) therapy, which reduces daytime sleepiness[1] and the risk of cardiovascular morbidity and mortality in the most severely affected patients (apnoea-hypopnoea index (measured as episodes per hour) >30).[2] For moderately affected patients (apnoea-hypopnoea index 15-30) who complain about snoring and daytime sleepiness, however, CPAP therapy may not be suitable.[3–5]

AS, a didgeridoo instructor, reported that he and some of his students experienced reduced daytime sleepiness and snoring after practising with this instrument for several months. In one person, the apnoea-hypopnoea index decreased from 17 to 2. This might be due to training of the muscles of the upper airways, which control airway dilation and wall stiffening.[6–8] We tested the hypothesis that training of the upper airways by didgeridoo playing reduces daytime sleepiness in moderately affected patients.

Methods

Participants and methods

We included participants aged >18 years with self reported snoring and an apnoea-hypopnoea index of 15-30 (determined by a specialist in sleep medicine within the past year). Exclusion criteria were current CPAP therapy, use of central nervous acting drugs (such as benzodiazepines), current or planned intervention for weight reduction, consumption of ≥ 14 alcoholic drinks a week or ≥ 2 a day, and obesity (body mass index (kg/m^2) ≥ 30).

We recruited patients at our study centre and one private practice. Physicians at the study centre assessed all potential participants for eligibility. Those willing to participate provided written informed consent. After enrolment, all patients completed a baseline assessment.

We randomised patients into an intervention group with didgeridoo training or a control group, with stratification for disease severity (apnoea-hypopnoea index 15-21 or 22-30 and Epworth score <12 or ≥ 12). The randomisation list was concealed from the recruiting physicians and the didgeridoo instructor.

Intervention and control

The instructor (AS) gave the first individual didgeridoo lesson immediately after randomisation. Participants learnt the lip technique to produce and hold the keynote for 20-30 seconds. In the second lesson (week 2) the instructor explained the concept and technique of circular breathing; this enables the instrumentalist to maintain a sound for long periods of time by inhaling through the nose while maintaining airflow through the instrument, using the cheeks as bellows. In the third lesson (week 4) the instructor taught participants how to further optimise the complex interaction between the lips, the vocal tract, and circular breathing so that the vibrations in the upper airway are more readily transmitted to the lower airways.[9] In the fourth lesson, eight weeks after randomisation, the instructor and the participants repeated the basics of didgeridoo playing. Participants had to practise at home for at least 20 minutes on at least five days a week and recorded the days with practice and the practice time (answer options for 0, 20, or 30 minutes).

ELPS

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Participants received a standardised acrylic didgeridoo that costs €80 (£43; $94). The didgeridoo is 130 cm long with a diameter of 4 cm and an elliptical embouchure with a diameter of 2.8-3.2 mm. Acrylic didgeridoos are easier for beginners than wooden ones.

Participants in the control group remained on a waiting list to start their didgeridoo training after four months.

Outcome measures

Our primary outcome was daytime sleepiness as measured by the Epworth scale. Scores range from 0 (no daytime sleepiness) to 24, and scores >11 represent excessive daytime sleepiness. Secondary outcomes included three additional sleep related outcomes measures: the apnoea-hypopnoea index, the Pittsburgh quality of sleep index, and a partner's rating for sleep disturbance. The cardiorespiratory sleep study was performed at the sleep laboratory with a computerised system (see bmj.com). The person analysing the sleep recordings was blinded to group allocation. The Pittsburgh quality of sleep index is a self administered questionnaire to determine sleep quality, latency, duration, and disturbance within the past four weeks.[10] The global score ranges from 0 to 21. A score of ≥ 5 represents impaired sleep quality. The partners (when present) rated their sleep disturbance by the participants' snoring during the previous seven nights, independently from the participants, using a visual analogue scale from 0 (not disturbed at all) to 10 (extremely disturbed). Finally, we used the German SF-36 to assess generic health related quality of life.

Analysis

For the primary analysis we compared change scores (differences between baseline and follow-up) between groups using two sample *t* tests. We also performed an analysis of covariance with the primary and secondary continuous end points at four months after randomisation as the dependent variables and their baseline values, markers of severity of disease (apnoea-hypopnoea index and Epworth score), weight change, and group allocation as independent variables.

To provide an overall estimate of the effects of didgeridoo playing on the four outcome measures we used a summary measure; we calculated a z score for each patient and outcome and then a summary score as the average of the four z scores, and then compared summary scores between the groups (see bmj.com).

Results

Fifty nine patients were assessed for eligibility and, after exclusions, 25 took part from August 2004 to April 2005. All completed the trial. Characteristics and baseline values of the didgeridoo and control groups were similar (see bmj.com). Most patients were men, aged about 50, and had an average apnoea-hypopnoea index of 21 and excessive daytime sleepiness (mean Epworth scores 11.8 in the didgeridoo group and 11.1 in the control group). The Pittsburgh quality of sleep index indicated impaired sleep quality (5.2 and 5.8) and the partners of the study participants on average had severely disturbed sleep (5.6 and 5.5). The SF-36 scores were in the range of the normal population with exception of the mental component and vitality scores, which were lower (reference scores of 50 for mental component and 63.3 for vitality).

Effects of intervention on sleep related outcomes

Outcome	Didgeridoo group	Control group	Raw difference* (95% CI)	Adjusted difference† (95% CI)
Epworth scale				
At 4 months	7.4 (2.3)	9.6 (6.0)		
Change from baseline	–4.4 (3.7)	–1.4 (2.6)	–3.0 (–5.7 to –0.3), P=0.03	–2.8 (–5.4 to –0.2), P=0.04
Pittsburgh quality of sleep index				
At 4 months	4.3 (2.1)	5.6 (2.7)		
Change from baseline	–0.9 (1.6)	–0.2 (1.7)	–0.7 (–2.1 to 0.6), P=0.27	–0.8 (–2.3 to 0.8), P=0.30
Partner rating of sleep disturbance				
At 4 months	2.3 (1.4)	4.8 (2.2)		
Change from baseline	–3.4 (2.4)	–0.6 (1.9)	–2.8 (–4.7 to –0.9), P<0.01	–2.7 (–4.2 to –1.2), P<0.01
Apnoea-hypopnoea index				
At 4 months	11.6 (8.1)	15.4 (9.8)		
Change from baseline	–10.7 (7.7)	–4.5 (6.9)	–6.2 (–12.3 to –0.1), P=0.05	–6.6 (–13.3 to –0.1), P=0.05

*Two sample *t* tests.
†Analysis of covariance with adjustment for severity of disease (apnoea-hypopnoea index and Epworth scale) and weight change during study period.

On average, participants in the didgeridoo group practised on 5.9 days a week (SD 0.86, range 4.6-6.9) for 25.3 minutes (3.4). The primary outcome (daytime sleepiness as measured by the Epworth scale) improved significantly in the didgeridoo group compared with the control group (table).

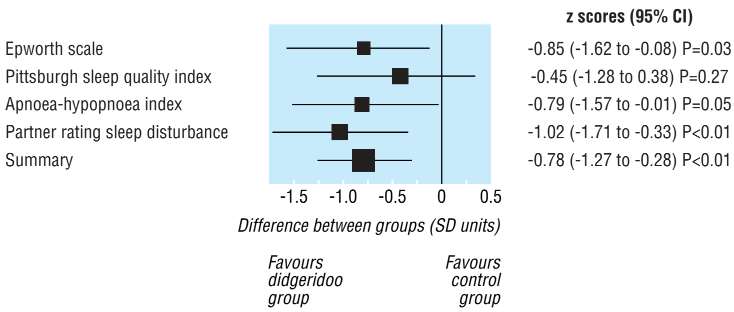
The quality of sleep did not differ significantly between groups, but the partners of those in the didgeridoo group reported less sleep disturbance. We also observed a significant effect of didgeridoo playing on the apnoea-hypopnoea index. Didgeridoo playing did not have a significant effect on any domain of the SF-36. Adjustment for severity of the condition and weight change during the study did not alter the results substantially for any outcome.

The figure shows the combined analysis of the four sleep related outcomes. The summary z scores differed by -0.78 (-1.27 to -0.28, $P<0.01$), favouring the didgeridoo over the control group.

Discussion

In this randomised controlled trial we found that four months of training of the upper airways by didgeridoo playing reduces daytime sleepiness in people with snoring and obstructive sleep apnoea syndrome. The reduction of the apnoea-hypopnoea index by didgeridoo playing indicated that the collapsibility of the upper airways decreased. In addition, the partners of participants in the didgeridoo group were much less disturbed in their sleep.

Earlier studies of the effects of electrical neurostimulation or training of the respiratory muscles



Effects of didgeridoo playing on measure of sleep related outcomes

What is already known on this topic

Snoring and obstructive sleep apnoea syndrome are highly prevalent sleep disorders associated with substantial morbidity and mortality and rising costs

Continuous positive airways pressure therapy can reduce daytime sleepiness, but compliance is often poor

Training or electrostimulation of the muscles of the upper airway might reduce collapsibility of the upper airways during sleep

What this study adds

Regular playing of a didgeridoo reduces daytime sleepiness and snoring in people with moderate obstructive sleep apnoea syndrome and also improves the sleep quality of partners

Severity of disease, expressed by the apnoea-hypopnoea index, is also substantially reduced after four months of didgeridoo playing

showed no improvement in daytime sleepiness[7] or the apnoea-hypopnoea index,[7 11] or were limited by the lack of a control group.[8] Our results show that training the upper airways significantly improves sleep related outcomes. The larger effects we observed may be due to the longer duration of our intervention and the training of the whole vocal tract instead of only single muscles.

Comparison with continuous positive airway pressure therapy

A meta-analysis of trials evaluating CPAP therapy in patients with moderate to severe obstructive sleep apnoea syndrome showed an average effect of −3.9 units on the Epworth scale.[1] The minimum important difference on this scale for severely affected patients is around 4 units. In our trial, the mean change score in the didgeridoo group was −4.4 units and the difference between the intervention and control group was −3.0 units. Thus the effect of didgeridoo playing seems to be slightly smaller than with CPAP therapy. However our patients were only moderately affected so that results are likely to be less pronounced.

One of the challenges in the treatment of sleep disorders is poor compliance. Thus new treatments not only need to be effective but also be ones that people are motivated enough to use. Participants in our trial were highly motivated and practised, on average, on almost six days a week, which was even more than the protocol asked for.

Strengths and limitations of trial

Strengths of our trial include the long duration of the training so that effects could develop. Also, we blinded outcomes assessors when possible and controlled for confounding by restricting the study sample to non-obese patients with little alcohol and drug consumption. Limitations are that those in the control group were simply put on a waiting list (a sham intervention for didgeridoo playing would be difficult) and that the sample size was small. Larger trials with more diverse study populations are needed to provide more precise estimates of the treatment effect of upper airway training.

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Competing interests: AS is a professional didgeridoo instructor and teaches t'ai chi and qi gong.

Ethical approval: Ethics committee of the University Hospital of Zurich.

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Exciting lessons

One of the things I love about studying medicine is that I can never be certain what will happen each day. Once, I was called at 10 pm to assist in a liver transplant operation. I was in awe while the liver was prepared, my first year anatomy rapidly flooding back. The dry pathology lectures came to life as I contrasted the healthy donor liver with a cirrhotic one destroyed by autoimmune hepatitis. I was amazed, as the organ was reperfused, by the sudden change from dead grey to a lively pink.

As I was retracting the organ back to allow the surgeons to complete the final anastomoses, I started to wonder what the donor had been thinking when she ate breakfast the previous morning. What was the last thing she felt as a subarachnoid haemorrhage struck her down? How did the recipient feel when she received the telephone call that she had been waiting, hoping, praying for? What were her thoughts as the anaesthesia put her to sleep—uncertain as to whether she would wake up again let alone the outcome of the operation?

What is exciting for me can be absolutely terrifying for a patient. An unrivalled learning opportunity could be someone else's tragedy. I'm still uncertain how to reconcile these conflicting emotions. It is just a year and a half before I graduate. Perhaps this is at least one thing I need to understand before I will deserve that title in front of my name.

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