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Integrated breathing and relaxation training (the Papworth method) for adults with asthma in primary care: a randomised controlled trial

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Background: An integrated breathing and relaxation technique known as the Papworth method has been implemented by physiotherapists since the 1960s for patients with asthma and dysfunctional breathing, but no controlled trials have been reported. This study evaluated the effectiveness of the Papworth method in a randomised controlled trial.

Methods: Eighty-five patients (36 men) were individually randomised to the control group (n = 46) or to the intervention group receiving five sessions of treatment by the Papworth method (n = 39). Both groups received usual medical care. Assessments were undertaken at baseline, post-treatment (6 months after baseline) and at 12 months. The primary outcome measure was the St George's Respiratory Symptoms Questionnaire (SGRQ). Secondary outcome measures included the Hospital Anxiety and Depression Scale (HADS), the Nijmegen dysfunctional breathing questionnaire and objective measures of respiratory function.

Results: Post-treatment and 12 month data were available for 78 and 72 patients, respectively. At the post-treatment assessment the mean (SD) score on the SGRQ Symptom subscale was 21.8 (18.1) in the intervention group and 32.8 (20.1) in the control group ($p = 0.001$ for the difference). At the 12 month follow-up the corresponding figures were 24.9 (17.9) and 33.5 (15.9) ($p = 0.007$ for the difference). SGRQ Total scores and HADS and Nijmegen scores were similarly significantly lower in the intervention group than in the control group. The groups did not differ significantly following the treatment on objective measures of respiratory function except for relaxed breathing rate.

Conclusions: The Papworth method appears to ameliorate respiratory symptoms, dysfunctional breathing and adverse mood compared with usual care. Further controlled trials are warranted to confirm this finding, assess the effect in other patient groups and determine whether there is some effect on objective measures of respiratory function.

There are currently an estimated 5.2 million people with asthma in the UK and 300 million worldwide.[1] Management is primarily through medication, although it is recognised that non-pharmacological approaches to reducing symptoms and improving health-related quality of life merit attention.[2 3]

A sequence of integrated breathing and relaxation exercises known as the Papworth method was developed in the 1960s (box 1).[4–7] This method focuses on problems of dysfunctional breathing including hyperventilation and hyperinflation that are often found in asthma sufferers.[3] The cycle of breathlessness and wheezing is frequently accompanied by anxiety and compounded by complex physiological mechanisms.[8] It is believed that the Papworth method leads to reduced asthma symptoms, anxiety and symptoms arising from hypocapnia. The present study was designed to investigate this hypothesis.

A Cochrane review on breathing exercises for asthma[9] found seven small-scale randomised controlled trials satisfying its inclusion criteria. Trends towards improvement were found but no reliable conclusions could be drawn concerning the effectiveness of breathing training for asthma, and it was recommended that further trials be undertaken (see also Thomas *et al*[10]). The interventions included in the review were predominantly based on either ancient yoga practices[11 12] or ''Buteyko techniques'', where emphasis is placed on hypoventilation and a reduction in β_2 agonist use.[13] To our knowledge, no randomised controlled trials of the Papworth method exist, despite the fact that it is in quite widespread clinical use.

METHODS

Participants and setting

The study was undertaken in a semi-rural GP practice in Welwyn, Hertfordshire with eight partners and 16 500 patients; 612 (4%) patients aged ⩾16 years are registered on the practice asthma database. The study took place between October 2004 and January 2006.

All 612 adult patients on the asthma register of the practice were initially approached to complete a postal survey about their condition; 359 patients responded. At the conclusion of the survey, respondents were invited to attend a physiotherapy-orientated asthma assessment. A total of 142 patients responded positively and 109 actually attended the assessment, 85 of whom met the inclusion criteria for the trial (fig 1; consort flowchart of patient withdrawals is available online at http://thorax.bmj.com/supplemental). Patients included in the study had to be aged 16–70 years, able to understand, read and write English, with a commitment to participate for possibly eight attendances, willing to give written informed consent and with no serious co-morbidity. The intention was that as few patients as possible would be excluded so that the sample would be maximally representative of a general practice asthma caseload. One patient in the control group requested withdrawal from the study to be able to receive treatment with the Papworth method. Six and 12 month data were available for 78

Abbreviations: HADS, Hospital Anxiety and Depression Scale; SGRQ, St George's Respiratory Questionnaire

Box 1 Summary of the Papworth method of treatment

The PM integrates five components, the principal one being specific breathing training:

- Breathing training, including teaching of appropriate minute and tidal volume and the development of a pattern of breathing suitable to current metabolic activity. Elimination of dysfunctional breathing, including hyperinflation and hyperventilation patterns is discussed. A specific Papworth method diaphragmatic breathing technique is taught to replace the use of inappropriate accessory muscles of respiration.[5 22] Emphasis, when relaxed, is placed on calm slow nasal expiration. Patients are encouraged to ''nose-breathe'' rather than ''mouth-breathe'' and eradication or reduction of habits such as yawning, sighing, etc is taught and practised.
- Education, with the emphasis on the recognition and physical management of stress responses and specifically the interaction with breathing patterns.
- Relaxation training, specific and general.
- Integration of ''appropriate'' breathing and relaxation techniques into daily living activities. Initially the techniques are taught in a semi-recumbent position progressing to sitting, then standing and during daily living activities. Finally, the integration of breathing and relaxation techniques into speech is taught and practised.
- Home exercises with an audiotape or CD containing reminders of the breathing and relaxation techniques are supplied at the third treatment. Encouragement is given to practise at least once a day with the tape.

and 72 patients, respectively. The reasons for loss to follow-up were primarily related to logistical or practical difficulties in attending (fig 1; consort flowchart of patient withdrawals is available online at http://thorax.bmj.com/supplemental).

Study design and procedures

This was a two-arm randomised controlled trial comparing an intervention group receiving five treatments by the Papworth method with a control group receiving no additional treatment. Both groups continued to receive usual asthma care including medication and routine asthma education from a practice nurse. The usual care did not include advice about breathing exercises.

Randomisation was undertaken by a computer-generated number sequence assigning consecutive subject ID numbers either a 1 or 2 to denote intervention or control condition. Masking/blinding of patients and therapist was obviously not possible; patients had to sign an informed consent and it is obvious whether they were receiving the treatment or not. Whereas it might in principle have been possible for the follow-up assessments to have been undertaken by an assessor blind to the randomisation, resources did not permit this.

The primary outcome measure was the St George's Respiratory Questionnaire (SGRQ).[14] This assesses impaired respiratory symptoms and quality of life relating to these. It has good repeatability and is sensitive to changes in disease activity.[15] A change in SGRQ Total score of 4 points is regarded as clinically significant.[15] The questionnaire yields three subscale scores relating to (1) experience of symptoms, (2) their impact and (3) impairment in levels of activity. It also yields a total score. Secondary self-report measures were the Hospital Anxiety and Depression Scale (HADS) yielding separate scores for anxiety and depression,[16] and the Nijmegen questionnaire[17 18] to assess hypocapnic symptoms (breathlessness accompanied by dysfunctional breathing in the form of hyperventilation).[19 20] A portable capnograph (Better Physiology) was used to measure end-tidal carbon dioxide and relaxed breathing rate over a 10 min period and standard spirometric parameters were also assessed (Micromedical Microloop). Each assessment session took approximately 1 hour. Assessments took place at baseline, post-treatment (approximately 6 months after baseline) and at 12 months. Ethical approval was obtained from the local research ethics committee.

Intervention: the Papworth method

Between the baseline and post-treatment assessment, the intervention group received five 60 min individual treatments with the Papworth method from a respiratory physiotherapist, as summarised in box 1. Ideally, the Papworth method is taught to patients in periods of remission in order that the techniques may be integrated into daily life activities and implemented at the first sign of symptoms.[7]

Sample size and power calculation

The sample size was calculated on the basis of a difference between intervention and control groups in the primary outcome measure (SGRQ Total score) of 12 units at post-treatment assessments, as found in a pilot study, and a standard deviation of the difference between baseline and post-treatment assessment of 14 units.[21] With these parameters, 23 patients in each group would yield 80% power at the alpha = 0.05 level (two-tailed). To take account of attrition rates of the order found in similar interventions (eg, Thomas *et al*[10]), we initially aimed to recruit 28 patients to each arm of the trial. In the event, a larger number of volunteers came forward from the recruitment process and, to avoid wasting the opportunity, these were included. The original randomisation process had generated sufficient numbers to include the extra participants.

Data analysis

Analyses were undertaken with SPSS V.11.5. Analysis of covariance (ANCOVA) was used to compare the control and intervention groups on primary and secondary outcomes at post-treatment and 12 month assessments, controlling for baseline scores. The outcome variables were normally distributed apart from two SGRQ domain scores (''activities'' and ''impact'') which had a positive skew which was not judged to be so great as to invalidate the use of an analysis of covariance with this sample size.

Analysis was undertaken on a ''per protocol'' basis rather than ''intention to treat''. Intention to treat analysis is more common in randomised controlled trials but, in this case, it was expected that loss to follow-up would not have been correlated with lack of improvement but was more likely to be due to practical or logistic issues, nor would it differ between the intervention and control conditions. Moreover, no satisfactory method could be found for imputing a value for patients lost to follow-up. If it turned out that loss to follow-up was high or different in the two study groups, this would undermine the interpretability of the findings.

RESULTS

No significant differences were found between the groups at baseline (tables 1–3). SGRQ Symptom mean scores were lower in the PM group than in the control group after treatment and

Table 1 Baseline demographic and clinical data

	Control group (n = 46)	Intervention group (n = 39)
N (%) male	18 (39)	18 (46)
Mean (SD) age (years)	49.3 (14.2)	50.2 (14.0)
N (%) married/cohabiting	36 (78)	34 (87)
N (%) Employment status		
N (%) full time	20 (44)	16 (41)
N (%) retired	10 (22)	11 (28)
Asthma impact factors:		
Mean (SD) years since asthma diagnosed	27 (17.7)	23 (15.2)
Mean (SD) years since first prescribed reliever medication	20 (13.6)	17 (13.0)
N (%) ex-smokers	14 (30)	14 (36)
N (%) current smokers	2 (4)	6 (15)
Spirometry (% predicted)	(n = 42)	(n = 38)
Mean (SD) FEV_1 (l)	91.67 (18.43)	87.24 (19.36)
N (%) FEV_1 <80% predicted	8 (17)	6 (15)
Mean (SD) FVC (l)	96.76 (13.58)	90.55 (18.34)
Mean (SD) PEF (l/min)	93.62 (21.31)	89.53 (21.80)

FEV_1, forced expiratory volume in 1 s; FVC, forced vital capacity; PEF, peak expiratory flow.

at 12 months (table 2). The post-treatment and 12 month SGRQ Total scores were significantly lower in the intervention group (table 2). The Nijmegen and HADS scores were also significantly lower in the intervention group than in the control group (table 2). Objective respiratory measures did not differ significantly across the groups, apart from breathing rate (table 2).

No adverse events were reported by patients or GPs.

DISCUSSION

These results support the hypothesis that the Papworth method ameliorates respiratory symptoms and improves quality of life in a general practice population of patients diagnosed with asthma. The effect was observed with reported symptoms and mood but no significant effect was observed on objective measures of lung function. To our knowledge, this is the first evidence from a controlled trial to demonstrate the effectiveness of the Papworth method.

The effect sizes on symptoms were clinically significant. A reduction of ⩾7 points in SGRQ domains in the intervention group is approximately double the change considered to be clinically relevant. Anxiety and depression scores were also reduced to a clinically meaningful degree. Significant reductions in Nijmegen scores together with a reduction in breathing rate in the intervention group suggested an improved ability to control the breathing rate consistent with metabolic requirements.

The fact that no significant change was observed in objective measures of lung function suggests that the Papworth method does not improve the chronic underlying physiological causes of asthma, but rather their manifestation.

There was no observable effect on patients' reports of the extent to which their activities were affected by their condition. However, in such a group with mild to moderate asthma, the level of impairment at baseline was small and there was limited scope for differential improvement in the intervention and control conditions.

A limitation of the study is a lack of detailed information on pharmacological treatment and changes in this over time during the trial. It would in principle be worthwhile examining how far, if at all, the intervention led to a reduction in medication usage or better adherence to medication regimens, but this would have been complicated by changes in prescribing practices while the study was going on and would have been difficult to interpret.

The Papworth method is a multi-component programme and we could not determine what element or elements contributed to its effect or even whether the elements combined synergistically. Because the comparison condition was usual care, we could not determine whether the Papworth method is more

Table 2 Effects on symptoms of five Papworth method (PM) treatments compared with usual asthma care only

	Baseline		Post-treatment (6 months post baseline)			12 months post-baseline		
	Control (n = 46)	PM (n = 39)	Control (n = 45)	PM (n = 33)	p Value*	Control (n = 40)	PM (n = 32)	p Value*
SGRQ Symptoms	35.1 (12.9)	42.9 (21.3)	32.8 (20.1)	21.8 (18.1)	0.001	33.5 (15.9)	24.9 (17.9)	0.007
SGRQ Activities	20.2 (17.4)	27.8 (21.3)	17.0 (17.5)	20.4 (18.8)	0.984	18.4 (18.9)	19.0 (15.7)	0.16
SGRQ Impacts	14.7 (11.53)	18.2 (14.8)	10.8 (11.0)	11.5 (11.5)	0.818	10.4 (10.7)	10.0 (10.1)	0.393
SGRQ Total	19.7 (11.3)	25.2 (16.1)	16.3 (12.2)	15.9 (14.0)	0.186	16.7 (11.6)	15.2 (10.9)	0.05
Nijmegen Total score	17.8 (9.1)	19.2 (11.0)	15.0 (9.5)	11.0 (9.7)	<0.001	14.2 (9.2)	11.9 (8.6)	0.015
HADS Anxiety	6.2 (3.8)	6.3 (3.5)	6.2 (3.7)	4.7 (3.1)	0.002	5.9 (4.1)	4.4 (2.7)	0.006
HADS Depression	2.2 (1.8)	3.3 (2.5)	2.4 (2.4)	2.2 (2.3)	0.075	2.6 (2.7)	2.1 (2.2)	0.03
$ETCO_2$ (mm Hg)	39.0 (3.7)	38.3 (5.5)	39.4 (4.4)	39.9 (4.6)	0.375	39.2 (3.4)	39.3 (6.0)	0.772
Relaxed breathing rate over 10 min	15.1 (2.5)	15.0 (3.3)	15.3 (2.4)	10 (3.0)	<0.001	15.3 (2.7)	9.6 (3.7)	<0.001

Values presented as mean (SD).
SGRQ, St George's Respiratory Questionnaire scores: range 0–100 (best–worst);
Nijmegen scores: higher scores indicate increased severity in symptoms from hypocapnia: range 0–64 (best–worst); HADS, Hospital Anxiety and Depression Scale: range 0–21 (best–worst); $ETCO_2$, end tidal carbon dioxide.
*From analysis of covariance comparing PM and control groups controlling for baseline scores.

Table 3 Effects on spirometric parameters of five Papworth method (PM) treatments compared with usual asthma care only

	Baseline		Post-treatment (6 months post baseline)			12 months post baseline		
	Control (n = 42)	PM (n = 38)	Control (n = 41)	PM (n = 32)	p Value*	Control (n = 37)	PM (n = 30)	p Value*
VC (l)	3.6 (1.0)	3.4 (1.0)	3.6 (1.0)	3.6 (0.9)	0.687	3.6 (1.0)	3.6 (0.8)	0.804
FEV_1 (l)	2.8 (0.9)	2.7 (0.9)	2.8 (0.9)	2.9 (0.8)	0.974	2.7 (0.8)	2.8 (0.7)	0.583
FVC (l)	3.5 (1.0)	3.4 (1.1)	3.5 (0.9)	3.6 (0.9)	0.151	3.4 (0.9)	3.6 (0.9)	0.345
PEF (l/s)	413.4 (130.1)	408.5 (141.7)	425.9 (120.0)	439.5 (113.2)	0.745	407.9 (119.4)	439.3 (109.1)	0.375

Values presented as mean (SD).
SGRQ, St George's Respiratory Questionnaire scores: range 0–100 (best–worst); VC, vital capacity; FEV_1, forced expiratory flow in 1s; FVC, forced vital capacity; PEF, peak expiratory flow.
*From analysis of covariance comparing PM and control groups controlling for baseline scores.

effective than other active treatment options that might be adopted over and above usual care. It may be noted, however, that patients in the control group received considerably more attention than would have been the case in usual care because of the repeated assessments. It seems unlikely, therefore, that the effects observed were simply due to increased attention.

The majority of patients had either mild asthma or symptoms well controlled with medication. It remains to be seen whether the Papworth method would benefit patients with more severe asthma. Asthma and chronic obstructive pulmonary disease are part of the same family of disorders, often co-exist, and are difficult to differentiate. It would therefore be of interest to determine whether the Papworth method could help patients diagnosed predominantly with the latter condition.

The most important limitation of the present study was that the same individual delivered the intervention and undertook the assessments. Although this is commonplace in studies of clinical/behavioural interventions, there is always the risk of patients responding to what they perceive as the expectations of the researcher. Such a bias may be expected to influence self-report measures across the board, so the fact that there was a marked improvement particularly in symptom scores suggests specific efficacy of the intervention. However, having obtained this positive finding, better funded studies are warranted that would enable independent assessments to be carried out.

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Figure 1 is available online at http://thorax.bmj.com/supplemental

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EH conceived and undertook this study with advice from RW. RW advised and participated in the analysis and interpretation. EH and RW wrote the manuscript. EH will act as guarantor.

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