



Evidence for the effectiveness of Alexander Technique lessons in medical and health-related conditions: a systematic review

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3 **Evidence for the effectiveness of Alexander Technique lessons in medical and**
4 **health-related conditions: a systematic review**
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28 **Disclosures**

29 J. P. Woodman teaches the Alexander Technique in private practice. She is a member of the
30 Scientific Research Committee of the Society of Teachers of the Alexander Technique,
31 contributing in a voluntary capacity.
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Abstract (word count: 273)

Background: Complementary medicine and alternative approaches to chronic and intractable health conditions are increasingly being used and require critical evaluation.

Objective: Systematic evaluation of available evidence for the effectiveness and safety of instruction in the Alexander Technique in health-related conditions.

Methods: PUBMED, EMBASE, PSYCHINFO, ISI Web-of-Knowledge, AMED, CINHAI-plus, Cochrane library and Evidence-based Medicine Reviews were searched to July 2011. Inclusion criteria were prospective studies evaluating Alexander Technique instruction (individual lessons or group delivery) as an intervention for any medical indication/health-related condition. Studies were categorised and data extracted on study population, randomisation method, nature of intervention and control, practitioner characteristics, validity and reliability of outcome measures, completeness of follow-up and statistical analyses.

Results: Of 271 publications identified, 18 were selected: three randomised, controlled trials (RCTs), two controlled non-randomised studies, eight non-controlled studies, four qualitative analyses and one health-economic analysis. One well-designed, well-conducted RCT demonstrated that, compared with usual GP care, Alexander Technique lessons led to significant long-term reductions in back pain and incapacity caused by chronic back pain. The results were broadly supported by a smaller, earlier RCT in chronic back pain. The third RCT, a small, well-designed, well-conducted study in individuals with Parkinson's disease, showed a sustained increased ability to carry out everyday activities following Alexander lessons, compared with usual care. The 15 non-RCT studies are also reviewed.

Conclusions: Strong evidence exists for the effectiveness of Alexander Technique lessons for chronic back pain and moderate evidence in Parkinson's-associated disability. Preliminary evidence suggests that Alexander Technique lessons may lead to improvements in balance skills in the elderly, in general chronic pain, posture, respiratory function and stuttering, but there is insufficient evidence to support recommendations.

Review criteria

Criteria for inclusion in the review were prospective studies in which instruction in the Alexander Technique was being evaluated as an intervention for a medical indication, or other health-related condition. PRISMA guidelines were followed. Eight publication databases were searched up to July 2011. Included studies were categorised by design and strength of evidence.

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4 **Message for the clinic**
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6 Alexander Technique lessons (one-to-one with a registered teacher) represent an appropriate
7 option to consider for patients with chronic back pain. Alexander Technique lessons may also help
8 individuals to better manage the disability associated with Parkinson’s disease. Further research is
9 required to determine the effectiveness of Alexander Technique lessons in other health-related
10 conditions.
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For Peer Review Only

Introduction

The Alexander Technique (AT) is a practical self-help method originally developed more than 100 years ago. The AT is generally taught one-to-one by trained professionals who combine hands-on guidance and verbal explanation to teach individuals how to diminish self-damaging postural and movement habits, and to modify habitual responses to stimuli, which can include pain and stress. The manual contact is used to guide individuals in everyday tasks, in order to help them experience altered movement coordination in a way that requires less effort. The instruction and manual guidance used in AT lessons differs markedly from that in disciplines such as physiotherapy or osteopathy.

The physiological basis of the AT is unclear but it is known to affect various aspects of motor behaviour. AT instruction has been shown to lead to altered postural regulation in standing, by reducing axial stiffness and increasing the adaptability of muscle tone [1]. Reduction in posture-related muscle activity and changes in posture have been well documented [2–5]. AT instruction has also been shown to lead to changes in the coordination of voluntary movement, including marked differences in spinal coordination, prolonged and smoother weight transfer and reduced body acceleration during whole body movement [4,6]. Evidence also suggests that balance and automatic balance recovery improve following AT lessons [7].

AT instruction has been employed for many years in the fields of acting and music, with objectively assessed improvements in performance [8–10]. A systematic review of the effectiveness of AT instruction for different medical conditions was conducted in 2003 [11] but, given subsequent research and the increased use of non-conventional-medicine approaches to healthcare, we consider it timely to review the available evidence.

The primary objective of this review was to evaluate systematically the currently available evidence for the effectiveness and safety of the use of AT instruction (one-to-one lessons or group delivery) in different medical conditions and other health-related areas. Studies were evaluated and categorised according to the strength of the evidence to identify areas where further research is required. The review also examines the evidence for how acceptable AT lessons are as a health-related intervention to individuals and to healthcare practitioners, as well as for the cost effectiveness of AT lessons.

Methods

The PRISMA (preferred reporting items for systematic reviews and meta-analyses) guidelines were used as a basis for constructing the review methodology [12]. The following electronic databases were searched to identify all relevant publications: PUBMED (1809–date), EMBASE (1974–date), PSYCHINFO (1806–date), ISI Web of Knowledge (≥ 1945 –date), AMED (Allied and Complementary Medicine; 1985–date) and CINHAL-plus (Cumulative Index to Nursing and Allied health; 1947–date). The last search date was July 2011. The search criteria were “Alexander technique [All Fields]”, with no date limits. In addition, reference sections from eligible studies and published reviews, and the Cochrane library and Evidence-based Medicine Reviews databases, were searched for studies not otherwise identified. Finally, Clin.Trials.gov and the metaRegister of Controlled Trials (www.controlled-trials.com), which includes the International Standard Randomised Controlled Trial Register Number (ISRCTN), were searched for details of ongoing trials.

Citations identified were assessed and information extracted separately by the two authors, with any disagreements regarding eligibility or differences in information to be extracted resolved by referral to a contributor to the paper. Criteria for inclusion were prospective studies in which instruction in the AT (one-to-one lessons or group delivery) was being evaluated as an intervention for a medical indication, or other health-related condition. Exclusion criteria were retrospective studies, non-medical/health-related indications, and secondary publications such as review articles and commentaries. Exclusion was generally made on the basis of information included in the title and abstract of the citation, with full papers retrieved where required.

All included studies were then categorised as i) randomised, controlled trials (RCTs), ii) controlled, non-randomised studies, iii) uncontrolled studies and case reports, iv) other (health economic analyses and qualitative research publications on prospective studies). For each study, the information extracted was: randomisation method (if applicable), study population, nature of the intervention, practitioner characteristics, nature of the control intervention (if applicable), whether outcome measures had been previously validated, the completeness of follow-up and statistical analyses conducted. For RCTs, the methodological quality of the studies was assessed using the modified Jaded scoring system [13], as described by Ernst and Canter [11]; thus the maximum score possible was 4.

Results

Of the 271 publications identified, 253 were excluded (Figure 1). A total of 18 studies met the inclusion criteria. Three studies were RCTs, two were controlled non-randomised studies, eight were non-controlled studies, four were qualitative analyses and one was a health-economic analysis.

Randomised, controlled trials

Of the three RCT studies identified, two were in chronic back pain and one in Parkinson's disease (Table 1).

Chronic back pain

The two RCTs of the effectiveness of AT lessons in chronic back pain are the ATEAM trial and a study by Vickers et al [14,15].

ATEAM trial

The ATEAM trial (Alexander Technique lessons, Exercise, And Massage; ISRCTN26416991) in patients with chronic or recurrent non-specific back pain [14] is acknowledged by the UK National Institute for Health and Clinical Excellence to be a well-conducted RCT with a low risk of bias [16].

Objectives

To determine the effectiveness of AT lessons for chronic or recurrent low back pain, in comparison with usual care. Massage, which can be an effective intervention for non-specific low back pain [17], was also included as a comparator and to allow assessment of any non-specific effects of attention and touch. The effect of exercise prescription was also assessed [14].

Study population

Patients had presented with non-specific low back pain at least 3 months previously and had current back pain of ≥ 3 weeks' duration [14].

Study design

The ATEAM trial had a factorial design that allowed the additional effect of GP-prescribed exercise to be assessed, either combined with or independently of the other interventions. Using a computer programme number generator, 579 patients were randomised to one of eight groups: i) usual standard GP care (e.g. continued monitoring, painkillers, referral for physiotherapy or

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3 surgery, as appropriate); ii) usual care plus therapeutic massage (one session per week for 6
4 weeks); iii) usual care plus six one-to-one AT lessons (Table 1); iv) usual care plus 24 one-to-one
5 AT lessons (Table 1); v) to viii) as for i) to iv) but with an exercise prescription for general aerobic
6 exercise such as walking, backed up by nurse-delivered behavioural counselling [14]. Six AT
7 lessons were chosen as being an affordable number from the perspective of the UK National
8 Health Service (NHS), and 24 AT lessons were selected to reflect private practice, where 15–30
9 AT lessons is typical for people with back pain.
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14 15 16 *Outcome measures*

17 Two main outcome measures were used, both previously validated in the back pain population
18 [18–20]. The Roland Morris disability score (RMS) is determined using a patient questionnaire with
19 more than 20 statements to ascertain the number of everyday activities that are limited by back
20 pain. It is generally considered that an improvement in the RMS of 2–3 points or more is
21 representative of a clinically significant change [21]. The second main measure was the number of
22 days that the individual was in pain for during the last 4 weeks. Secondary outcomes included
23 measures of quality of life, pain, incapacity and enablement. All outcome measures were assessed
24 at baseline, 3 months and 1 year, with the primary analysis at 1 year to evaluate the long-term
25 effects of the interventions [14].
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33 34 *Findings*

35 At baseline participants had on average 27 days of back pain out of every 28 days and they had an
36 average RMS of 11. At 3 months, all interventions had a statistically significant benefit compared
37 with usual GP care, with the biggest difference observed in the 24 AT lesson group (mean -2.91
38 point change in RMS score and median 16 less days in pain per month than usual care; $p < 0.001$
39 for both), [14].
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45 The outcome at 1-year is, however, of more interest since it indicates longer-term effects of
46 interventions which had since ended (assessment 10–11 months after completion of 6 AT lessons
47 or massage, and 7 months after the majority of the 24 AT lessons). First, with respect to the RMS
48 scores, the difference between the massage and usual care groups was no longer significant at 1
49 year (Figure 2a, Table 1). In contrast, in the 6 AT group, the difference in RMS from usual care
50 was statistically significant but it would not generally be considered clinically significant (Figure 2a,
51 Table 1). In the 24 AT lesson group the difference in RMS from usual care was both clinically and
52 statistically significant (Figure 2a, Table 1).
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3 On the second main outcome measure, at 1 year, both the massage and 6 AT groups had
4 significant reductions in days in pain compared with the usual care group (Figure 2b, Table 1). The
5 most striking results, however, were observed with the 24 AT lesson group, which had a median 3
6 days of pain/4 weeks compared with 21 days for the usual care group (Figure 2b, Table 1).
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11 Of note, in the group which received 24 AT lessons, both the RMS and the number of days in pain
12 actually improved between 3 months and 1 year, and in the 6 AT group the outcome measures
13 were fairly stable over this time. In contrast, there was a waning of benefit in the massage group
14 on both measures from 3 months to 1 year [14]. The improvement (24 AT group) or maintenance
15 (6 AT group) of benefits over the longer term suggests that patients had continued to apply what
16 they had learnt in their AT lessons to their daily life.
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22 The factorial trial design permitted combining data for participants in all groups who did and did not
23 receive exercise prescription. An overall modest but beneficial effect of exercise on the RMS at 1
24 year was seen (difference of -1.29, 95% CI: -2.25, -0.34; $p=0.008$ i.e. statistically but not clinically
25 significant); the reduction in pain for exercise versus no exercise was not statistically significant.
26 Results for the individual groups, i.e. intervention plus or minus exercise, showed significant
27 improvement in RMS for massage plus exercise (-2.37, $p=0.015$), 6 AT plus exercise (-2.98,
28 $p=0.002$) and 24 AT irrespective of exercise or no exercise (-4.22 and -4.14, $p=0.002$ and $p<0.001$,
29 respectively), compared with the usual care no exercise group which acted as control for this
30 analysis [14]. Significant reductions in number of days in pain compared with control were
31 observed for all four AT groups: -13 days for both 6 AT alone and 6 AT plus exercise ($p<0.05$) and
32 -20 days for both 24 AT alone and 24 AT plus exercise ($p=0.001$). The difference in days in pain
33 between the control and massage plus or minus exercise was not significant, which is incongruent
34 with the overall results for massage and may, perhaps, be explained by the smaller group sizes in
35 the individual group analysis.
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47 Of the secondary measures, the 24 AT lesson group had significantly better results than the usual
48 care group on all but one (SF-36 mental) of the 11 measures/sub-scales ($p<0.01$; Table 1).
49 Overall, the results for the 6 AT and massage groups were quite similar (Table 1).
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53 No adverse events were reported in any of the 288 participants in the AT groups nor in any of
54 those who received exercise prescription. One person (<1%) in the massage group reported a
55 worsening of back pain which was attributed to the intervention [14].
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Study limitations

Limitations of the trial include the fact that it was largely predicated on 6 AT lessons as the principal test intervention, with implications for data interpretation and possibly study design. In terms of design, a group receiving 24 massage sessions would have provided the most appropriate control for non-specific effects for the 24 AT lesson group (perhaps this was not selected because this number of massage sessions may not reflect usual practice). One can, nonetheless, conclude that, overall, the trial adequately controlled for non-specific effects of individual care and attention, since 6 AT lessons consistently led to a higher magnitude of improvement than massage, with statistically significant differences from control in nearly all main outcome measures (overall results or by individual groups). Furthermore, the fact that the improvement at 3 months continued to increase up to 1 year in the group receiving 24 AT lessons, and benefit was maintained in the 6 AT lesson group, suggests that individuals had integrated the AT into their daily lives and were able to self-manage to further progress their recovery. In contrast, massage has little explicit educational content, and benefits began to disappear once the sessions had ceased.

While the factorial nature of the trial design allowed for analysis by individual groups, it is nonetheless surprising that there was a focus on these results, given the smaller group size and hence less statistical power of these analyses compared with the overall results. Hence, the effectiveness of the 6 AT lessons plus exercise group was highlighted, despite the fact that 24 AT lessons led to the greatest and most consistent improvement across all outcome measures and that this benefit occurred regardless of exercise prescription. The conclusion that '6 lessons followed by exercise prescription were nearly as effective as 24 lessons' [14] is debatable given that 6 lessons plus exercise were only 65% as effective on days in pain and 72% as effective on the RMS.

Conclusions

The ATEAM scored the maximum possible for methodological quality on the modified Jaded score (Table 1). Outcome measures were comprehensive and appropriate and previously validated for this patient population. Patient disposition was documented and adherence was high with 91% attending $\geq 5/6$ massage sessions, 94% attending $\geq 5/6$ AT lessons and 81% attending $\geq 20/24$ AT lessons. In addition, 81% of participants completed the questionnaires at 3 months and 80% at 1 year. Another strength of the study was that more than 150 AT teachers and massage therapists delivered the interventions, ensuring a representative spread and negating any individual practitioner effects. A clear, long-term benefit of AT lessons for both the pain and disability

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2 associated with chronic back pain has been demonstrated. It would appear that the optimum
3 number of AT lessons, suitable for the majority of people with chronic back pain, has not been
4 established but may lie somewhere between 6 and 24 lessons.
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8 ***Vickers et al study***

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10 A second, smaller and earlier RCT of AT lessons for chronic back pain was conducted by Vickers
11 et al [15].
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14 *Objective*

15 To assess the effect of AT lessons on pain intensity, disability caused by pain and pain behaviour
16 associated with chronic non-specific back pain, with follow-up to 1 year [15].
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20 *Study population*

21 As in the ATEAM, patients (N=91) had non-specific low back pain but, unlike the ATEAM, were
22 recruited from hospital out-patient pain clinics. Inclusion criteria were a ≥ 2 -year history of low back
23 pain, or current episode of > 3 -month duration [15].
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30 *Study design*

31 Patients were randomised to one of three groups (randomisation method not reported): i) 20 one-
32 to-one AT lessons given over 10 weeks ii) usual care with no additional intervention iii) attention
33 control: weekly group support sessions given over 10 weeks (by the AT teacher) to control for any
34 non-specific benefits of AT lessons. All patients continued to receive usual care as appropriate,
35 although physiotherapy was excluded [15].
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42 *Outcome measures*

43 Outcome measures were: pain rated on a visual analogue scale (VAS), a raw pain score, a
44 disability score based on number of daily tasks limited by back pain and an inappropriate-pain
45 behaviour score. Results were analysed by determining change from baseline in each outcome
46 measure for each arm at each timepoint and comparing these changes across arms [15].
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51 *Findings*

52 At the end of the 10-week intervention period, the AT group had lower pain and disability than the
53 other two arms: disability ($p < 0.001$), pain behaviour ($p < 0.001$), VAS ($p = 0.05$), raw pain score
54 ($p = 0.07$), (Table 1). At 6 months, the disability score remained significantly lower for the AT arm
55 compared with usual care ($p = 0.005$), but this score was not assessed at 12 months. VAS and raw
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3 pain scores were both numerically lower in the AT arm than the other arms at both the 6-month
4 and 12-month follow-ups but the differences were not statistically significant. Safety was not a
5 specified study outcome but no safety issues were reported [15].
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8 9 *Study limitations*

10 All the AT instruction was delivered by only one teacher, making it more difficult to generalise the
11 findings to the private practice setting than if a larger number of teachers had been involved. A
12 further limitation is that it would appear that not all the outcome measures were validated and two
13 of the measures (raw pain score and inappropriate-pain behaviour) were indirect, being rated by a
14 clinician based on patient reports. It is also unclear how the relatively high drop-out rate in the
15 study affected the results (39% at 3 months and 49% at 1 year).
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22 *Conclusions*

23 The study scored 3/4 for methodological quality on the modified Jaded score (Table 1). The
24 significant reductions in pain and disability caused by pain that followed AT lessons appeared to be
25 unrelated to non-specific effects of attention. However, the gradual reduction in benefits over the
26 longer-term stands in contrast to the results of the ATEAM trial where benefit was maintained to at
27 least 1 year.
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33 **Parkinson's disease**

34 The effectiveness of AT lessons in helping people overcome some of the disabilities associated
35 with Parkinson's disease has been evaluated in one RCT (Table 1), [22].
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40 *Objectives*

41 The primary objective was to determine whether AT lessons would reduce motor and postural
42 disability in individuals who were continuing to receive conventional pharmacotherapy for
43 Parkinson's disease. Secondary objectives included impact on depression, and whether any
44 observed benefits were due to non-specific effects of receiving individual attention and hand
45 contact [22].
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51 *Study population*

52 Participants had diagnosed idiopathic Parkinson's disease [22].
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Study design

The study design was informed by a previous pilot study [23]. Ninety-three participants were randomised to one of three intervention arms: i) 24 bi-weekly one-to-one AT lessons; ii) 24 bi-weekly massage sessions; iii) no additional intervention (usual care). A computerised method was used to balance the arms for age, gender, and disease duration and severity. This was not a direct comparative study of AT lessons with massage, rather the massage arm (in addition to any massage-specific benefits) provided an equivalent amount of touch and individual attention to control for non-specific effects of AT lessons [22].

Outcome measures

The primary outcome was the self-assessment Parkinson's disease disability scale (SPDDS) which evaluates ability to perform a range of daily activities independently and was recorded at the best and worst times during a one-week period. Secondary outcome measures included the Beck depression inventory (BDI) and the attitude-to-self scale (ASS). Postal questionnaires were used and data collection and analysis was performed by independent research staff blinded to intervention allocation [22].

Findings

Compared with usual care, significant improvement was observed in the AT group from baseline to post-intervention in the primary outcome measure of SPDDS, regardless of whether measured at best ($p=0.04$) or worst time ($p=0.01$; Table 1). The difference between groups was maintained at the 6 month follow-up ($p\leq 0.04$). In contrast, no significant differences in SPDDS were observed between massage and usual care at any timepoint. Significant improvements were also observed in the AT arm compared with usual care on the secondary outcomes for some timepoints (BDI post-intervention, $p=0.03$ and ASS at the 6-month follow-up, $p=0.04$; Table 1). Comparisons between the massage arm and usual care for the secondary outcomes showed no significant differences, although there was a positive trend for the BDI. Qualitative self-report measures revealed an overall greater degree of change for the AT arm, with improvements in balance, posture and walking cited frequently, as well as increased coping ability and reduced stress. For massage, the most commonly cited benefits were relaxation and a sense of well-being. A further finding was a significantly lower rate of change of Parkinson's disease medication during the study in the AT group than for either usual care or massage ($p=0.001$). Again, safety was not a specified study outcome but no safety issues were reported [22].

Study limitations

Limitations include the fact that the sample size was relatively small with approximately 30 participants per intervention arm. In addition, the AT lessons were delivered by only two teachers, hence the extent to which the findings can be generalised to the AT private practice setting as a whole is unclear.

Conclusions

This was a well-designed and well-conducted study with a low risk of bias (Jaded score 3/4). Balancing of groups for various baseline variables was performed but a randomised, computerised method was used for this. The study included design features to control for potential confounding factors between arms e.g. having uniform surroundings and a similar professional appearance of the practitioner. Outcome measures were appropriate and previously validated for this patient population or, in the case of attitude-to-self scale, in a similar population. Data documentation and follow-up was comprehensive. The significant improvements in the primary and secondary outcome measures compared with usual care that occurred in the AT arm were not observed in the massage arm, suggesting that non-specific effects of individual care and attention were not responsible for the changes. Overall, the study demonstrated that lessons in the AT for people with Parkinson's disease led to an increased ability to carry out everyday activities which was sustained at 6-month follow-up. One of the most interesting findings is the lower rate of change in Parkinson's medication in the AT group; any potential means of slowing the rate of dose increase in this progressive disease deserves further study.

Controlled, non-randomised studies

Two small, controlled studies were identified (Table 2).

Balance in the elderly

Study population and design

Dennis [24] assessed the effect of AT intervention on balance in elderly volunteers using the functional reach test, a standard clinical measure of postural stability (balance). Volunteers were more than 65-years old and mostly female. AT instruction was provided as eight sessions over 4 weeks in a group setting. Following a pilot with six volunteers, a further seven were recruited to the active intervention group and six to a no-intervention control group.

Findings

Functional reach was significantly greater post-AT intervention than at baseline, with a 32% improvement in the experimental AT group ($p < 0.025$) and 41% improvement in the pilot AT group ($p < 0.05$). The change in functional reach was also significantly greater for the AT group compared with the control group ($p < 0.005$). A follow-up test in the experimental AT group 1 month later showed a slight reduction in the degree of improvement, suggesting that eight group AT sessions may have been insufficient to fully maintain the change [24].

Study limitations and conclusions

Participant numbers were small and allocation to intervention arms did not use randomisation. However, the control group will have mitigated any bias produced as a result of test practice. Validation studies have shown functional reach to correlate well with common reaching tasks in daily life [25] but it should be noted that it is now optimally employed as part of a battery of balance tests [26]. Finally, it may have been more appropriate if the study had only included elderly people with confirmed balance problems, or a history of falls.

Respiratory function

Study population and design

One study, together with its earlier pilot, has assessed the effect of AT lessons on respiration [27,28]. Twenty healthy volunteers were enrolled: ten received at least 20 one-to-one AT lessons at approximately weekly intervals, while ten matched controls received no intervention. Spirometric tests were administered by a trained technician, blinded to the study group, at baseline and at 6.8 months [27].

Findings

No significant changes were observed in the control group in any of the seven measures (Table 2). In the AT group, significant changes from baseline were observed in four of the seven measures, suggesting some improvement in respiratory muscular strength and endurance, although differences between the two groups did not reach statistical significance [27].

Study limitations and conclusions

Limitations include the small sample size and the lack of randomisation. The control consisted of no intervention, so potential non-specific effects of the individual attention received were not controlled for but any effects of test practice were. Finally, while spirometric tests are widely used in clinical practice, the physiological relevance of the observed changes in these healthy adults to

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3 a compromised population such as asthma patients is questionable, although such transferability
4 was not a claim made by the authors.
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7 **Uncontrolled studies and case reports**

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9 The eight uncontrolled studies identified were conducted in diverse areas (Table 2). Since none
10 had a control group the findings are associated with an inherent high risk of bias.
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13 **Balance in the elderly**

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15 In addition to the controlled study on balance in the elderly already described, Batson and Barker
16 [29] carried out a similar-sized, uncontrolled study that evaluated a wider range of validated
17 outcome measures (Table 2).
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20 *Study population and design*

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22 An interesting feature of this study is that it was a feasibility study for group-learning of the AT,
23 whereas AT instruction is generally delivered one-to-one. Nineteen volunteers (mean 78 years)
24 were recruited from residential homes and community centres. All but two had a history of falls and
25 most had varying degrees of fear of falling. Two validated outcome measures of balance were
26 included, the timed 'up-and-go' (standing from a seated position, walking 3 metres and returning to
27 sitting) and the Fullerton advanced balance scale (a 10-item test of different activities requiring
28 balance). A third validated test, the modified falls efficacy scale assessed fear of falling during 10
29 different daily activities. All tests were carried out independently by two physiotherapists.
30 Instruction in the AT was given in a total of ten, 1.5 hour group sessions over 2 consecutive weeks
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42 *Findings and conclusions*

43 A total of 18 out of the 19 completed the 2-week study. The average group timed up-and-go test
44 improved by almost 2 seconds from baseline ($p=0.006$) and this was considered to be due to
45 improved overall motor performance, rather than increased risk taking. In addition, the average
46 Fullerton Advanced Balance score was improved from baseline ($p=0.052$) but no clear change was
47 seen in the modified falls efficacy scale [29]. This was a robustly designed and well-conducted
48 pilot. A follow-up study would be highly justified, with outcomes assessed longer-term and a control
49 arm such as a conventional fall-prevention programme.
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Posture and surgical ergonomic skills

Reddy et al [30] reported a pilot study of posture and surgical ergonomic skills in trainee surgeons pre- and post-AT lessons (Table 2). Seven underwent a routine basic skill test in laparoscopic (minimally invasive) surgery, as well as an assessment of posture. The tests were repeated after eight one-to-one AT lessons, with each subject serving as their own control. Compared with baseline, significant differences were observed in post-intervention postural assessment scores for the neck, spine, shoulder, hands and fingers, as well as in the time load test of postural endurance ($p < 0.05$). Post-intervention tests also showed significantly improved ergonomics, ability to complete the laparoscopic skill sets (suturing and cutting) and reduction in hand tremor compared with baseline ($p < 0.05$), [30].

Stuttering

Two individuals with persistent stuttering were enrolled in a study which provided 30 one-to-one AT lessons (Table 2), [31]. Eight of the 17 physical and psychological measures related to stuttering showed significant improvements compared with baseline in one or both participants, for example successful influencing of stuttering ($p = 0.04$ and $p = 0.03$ for the two subjects), [31]. However, the 17 measures were not validated and not all were objective assessments.

Learning disabilities

Maitland et al [32] conducted an exploratory study to assess any changes in physical functioning and anxiety levels following one-to-one AT lessons in eight adults with varying degrees of learning disability and associated physical problems (Table 2). Assessments were mostly subjective and were made jointly by the AT teacher and a physiotherapist. In 7 out of 8 participants small, but noticeable changes were observed following lessons: improved mobility/reduction in muscular tension, and in anxiety measured with a recognised behavioural relaxation rating scale [32].

Other studies

Four further studies will not be discussed in detail (Table 2). A pilot study in seven individuals with Parkinson's disease showed significant improvements following AT lessons in three out of four validated self-report outcome measures, including one of depression [23]. Secondly, a case report described a marked reduction in back pain following AT lessons [7]. Finally, instruction in the AT has been reported in two studies as part of multidisciplinary pain management programmes for patients with chronic pain [33,34], but it was not possible to determine the specific contribution of the AT to the observed improvement (Table 2).

Cost effectiveness

AT lessons are generally paid for privately but several healthcare insurance companies will reimburse costs in certain circumstances, and some UK pain clinics will provide AT lessons for chronic pain patients. One economic analysis of the AT has been identified [35].

Findings

This analysis of the ATEAM trial was conducted from the perspectives of the UK National Health Service, the participants' personal costs and society. The analysis demonstrated cost-effectiveness of AT lessons for chronic back pain, concluding that 6 AT lessons followed by exercise prescription was the most cost-effective option of those examined [35]. While exercise prescription alone and 6 AT lessons alone both had a greater than 85% probability of being below the conventionally accepted threshold of £20,000 per quality-of-life-adjusted year (QALY) gained, AT lessons performed better than exercise prescription across the range of cost-effectiveness outcomes measured (QALYs, cost per point reduction in disability score and per reduction in pain-free days). Six AT lessons followed by exercise prescription cost £43 per additional pain-free day, £64 per additional point reduction on the disability score and £5,332 per QALY gained [35].

Limitations and conclusions

No cost-effectiveness analysis of 24 AT lessons compared with usual care control was reported, despite the greater clinical effectiveness of 24 AT lessons versus 6 lessons [14]. In this analysis, only the 6 AT lesson arm was compared with the usual care control, and the cost-effectiveness of 24 lessons was instead compared with that of 6 AT lessons. The analysis also experienced a high degree of missing data, with questionnaire data available for only 53% of participants, which may explain the high degree of variability within the data on resource use and resource costs [35]. Nonetheless, the analysis provides the first evidence of cost-effectiveness of AT lessons.

Healthcare professionals' and participants' expectations and experiences of the AT

The study of the extent of acceptability of different healthcare interventions to patients, often using mixed qualitative and quantitative research methodology, constitutes an expanding field which allows evaluation of the patient's expectations and experience.

Participants' perceptions

As an integral part of the ATEAM trial, Yardley et al [36] studied patients' attitudes to, and experiences of, AT lessons (n=183) compared with exercise prescription (n=176) using a

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3 structured questionnaire. Note that there was some overlap between the two groups because of
4 the trial's factorial design. In-depth interviews were also conducted with a selected sample of
5 participants in the two groups (24 participants at baseline and 15 of these at 3 month follow-up) to
6 elucidate the beliefs and motivations relating to responses to key elements of the questionnaire. At
7 study entry, participants in both AT and exercise groups had a positive attitude to their intervention,
8 based on an expectation for some improvement. At the 3-month follow-up the participants' attitude
9 to exercise had not changed. In contrast, participants' attitude to AT had become more positive,
10 with a significant change in the questionnaire results ($p < 0.001$). This change resulted from a
11 perceived increased ability to cope with and prevent back pain. Unlike for exercise, few barriers to
12 learning the AT were reported, particularly since it 'made sense' and could be practised while
13 carrying out everyday activities [36]. The high rate of attendance at AT lessons in the ATEAM
14 (88%) also provides an indication of good acceptability to individuals with chronic back pain [14].
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24 Fisher [34] described a multidisciplinary pain management programme (N=34) in which AT
25 instruction was consistently rated by the study participants as the component of highest value
26 (mean subjective rating on 10-point scale during the study and 3-month and 1-year follow-up). The
27 programme consisted of educational lectures / group discussions with nurses, physiotherapists
28 and psychologists, auto-hypnosis and relaxation, personal exercise training and AT sessions.
29 Finally, in the occupational setting, a study of group AT instruction for medical sonographers
30 (N=96) delivered with the aim of reducing work-related musculoskeletal disorders, revealed that
31 86% found that AT was relevant to the practice of ultrasound and 83% thought they would be able
32 to apply what they had learnt to their work [37,38].
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40 **Healthcare professionals' perceptions**

41 Beattie et al [39] conducted in-depth semi-structured interviews towards the end of the ATEAM trial
42 with a sample of 20 GPs, nurses, massage therapists and AT teachers (5 in each group). They
43 found that GPs and nurses perceived AT lessons, with or without exercise, as more beneficial and
44 acceptable than massage, and concluded this may be related to the educational and self-care
45 nature of the AT [39].
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51 We have also included one other study assessing healthcare professionals' attitudes to the AT,
52 although strictly it was not a prospective study of AT *per se*. In this study, 875 Canadian primary
53 care physicians completed a questionnaire on their beliefs about the therapeutic effectiveness of
54 15 different complementary / alternative healthcare interventions [40]. The majority (79%) of the
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3 physicians had not heard of the AT which may explain the relatively low rating given (ranked joint
4 twelfth out of 15).
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7 ***Future and ongoing research***

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9 The search of clinical trials registries revealed no ongoing or planned participant trials of the AT but
10 an RCT of AT lessons compared with usual care for chronic neck pain is due to begin in late 2011.
11 Research is also continuing into other areas, including the physiological and psychological basis of
12 the AT.
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17 **Discussion**

18 **Evaluation of current evidence for the effectiveness and safety of AT instruction**

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20 The extent to which AT instruction becomes accepted as a valid intervention for medical and
21 health-related conditions will depend on the weight of the supporting evidence, its acceptability to
22 potential users and to healthcare providers alike, as well as its cost-effectiveness.
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28 Although few studies have been conducted on the efficacy and safety of instruction in the AT, the
29 current analysis has identified strong evidence for the effectiveness of AT lessons in chronic back
30 pain. This conclusion is based on the existence of two RCTs of a high quality design that produced
31 credible outcomes, criteria that are generally accepted as denoting a strong level of evidence [41].
32 The ATEAM trial in particular, provides convincing evidence of the long-term effectiveness of AT
33 lessons in chronic back pain, with the low risk of bias suggesting that the observed efficacy reflects
34 specific effects of the AT intervention. Of interest, chronic back pain is currently the most common
35 single reason that people first seek AT lessons [42].
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43 The ATEAM results for AT lessons compare favourably with conventional primary care treatments
44 for chronic back pain. In the trial itself, AT lessons consistently provided greater long-term benefit
45 than therapeutic massage. While caution must be exercised in comparing results across trials, the
46 ATEAM shared a similar design, methodology and study population to the BEAM trial of spinal
47 manipulation, plus or minus exercise, compared with usual GP care for low back pain [43]. In
48 BEAM, the maximum net benefit (difference from usual care) in RMS at 1 year was 1.30 which was
49 achieved with manipulation plus exercise; this difference was statistically significant but would not
50 generally be considered clinically significant. Corresponding values in the ATEAM were 3-fold
51 higher than this for 24 AT lessons (with or without exercise) and 2-fold higher for 6 AT lessons *plus*
52 exercise, both of which were statistically and clinically significant [14]. Given also that a meta-
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3 analysis of 26 RCTs has concluded that spinal manipulative/mobilisation therapy gave no added
4 benefit to usual GP care for chronic low back pain [44], a course of 6–24 AT lessons should
5 perhaps be given more consideration as an appropriate option to offer patients with this condition.
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9 Moderate evidence for the effectiveness of AT lessons in reducing disability associated with
10 Parkinson's disease was also identified. There was a low risk of bias with the one small, well-
11 conducted RCT in Parkinson's, suggesting that the outcomes reported are likely to reflect true
12 effects of the AT intervention. Based on this trial, the UK National Institute for Health and Clinical
13 Excellence recommends that AT lessons may be offered to benefit people with Parkinson's by
14 'helping them to make lifestyle adjustments that affect both the physical nature of the condition and
15 the person's attitudes to having Parkinson's disease' [45].
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21 The long-term benefit of AT lessons observed in both the ATEAM and Parkinson's trials is
22 consistent with the inherently educational nature of the Technique. Indeed, the skills acquired in a
23 series of AT lessons have been shown to be retained in the long term, being widely and
24 consciously employed in daily life [46].
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30 Exploratory studies have observed an apparently beneficial effect of AT instruction in a diverse
31 range of medical conditions and various measures of human function. These studies were
32 generally small in size and were either uncontrolled, or poorly controlled. The preliminary nature of
33 the evidence points to the need for further research to be conducted. Because AT training appears
34 to affect fundamental aspects of motor control, such as spinal stiffness, spinal coordination, weight
35 transfer and balance [1,4,6,7], it could plausibly benefit a broad range of clinical conditions.
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41 Few of the studies reviewed discussed safety or acceptability of the intervention. However, in the
42 ATEAM trial, which is the largest AT study to date, no adverse events were observed in the 288
43 participants who received AT lessons. Indeed, AT intervention is widely perceived as very low risk.
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48 **Limitations of the review**

49 The analysis is limited by the relatively small evidence base for the AT; hence no meta-analysis or
50 other statistical evaluation of the evidence is feasible. This is not surprising given the general lack
51 of research funding to support large studies into alternative and complementary approaches to
52 healthcare.
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3 It should be noted that all of the controlled studies reviewed here involved AT teachers trained and
4 registered by the Society of Teachers of the Alexander Technique (STAT), or its international
5 affiliates. STAT is the largest but not the only professional association for AT teachers in the UK.
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9 We are also cognisant that the review processes and tools used were designed to systematically
10 assess the evidence base for conventional pharmaceutical-based interventions rather than
11 alternative or complementary interventions. For example, the scoring systems used to assess the
12 methodological quality of a trial often rely heavily on the use of blinding and placebo controls.
13 While the RCTs described here aimed to control for the non-specific effects of individual care and
14 attention [14,15,22], a clear confounder is that blinded trials of the AT are not possible due to the
15 nature of the lessons, and controlling for placebo effects can be problematic. Review and
16 modification of such tools to make them more suitable for evaluating smaller studies that may not
17 closely follow traditional design criteria may, therefore, be desirable. In this respect, it is interesting
18 to note that observational studies do not necessarily yield less reliable results than RCTs [47,48].
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27 A further point receiving increasing attention in RCT methodology is the benefit of developing
28 mixed-methods approaches, drawing on both quantitative and qualitative research. Such
29 methodologies may elucidate the patient's perspective and experience of the intervention and the
30 trial [49,50], leading to a better understanding of the processes and outcome of a RCT, as well as
31 providing means for improving the intervention.
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38 **Conclusions**

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40 AT lessons represent an appropriate intervention to offer patients with chronic, non-specific back
41 pain and may help patients with Parkinson's make appropriate lifestyle adjustments. Instruction in
42 the AT is increasingly being sought by individuals looking for help in a wide range of conditions and
43 as a means to improve overall health and well being. Further well-designed, controlled studies are,
44 therefore, needed to robustly evaluate the effectiveness and safety of AT lessons, including in
45 areas where there is currently only preliminary evidence, namely balance in the elderly, respiratory
46 function, stuttering, posture, chronic pain, muscular tension and anxiety.
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Author contributions

JW was responsible for the concept and design of the review, performed data collection and data interpretation/analysis, was the principal author and approved the final manuscript. NM performed data collection and data interpretation/analysis, wrote the initial draft of sections on qualitative data, critically revised the paper and approved the final manuscript.

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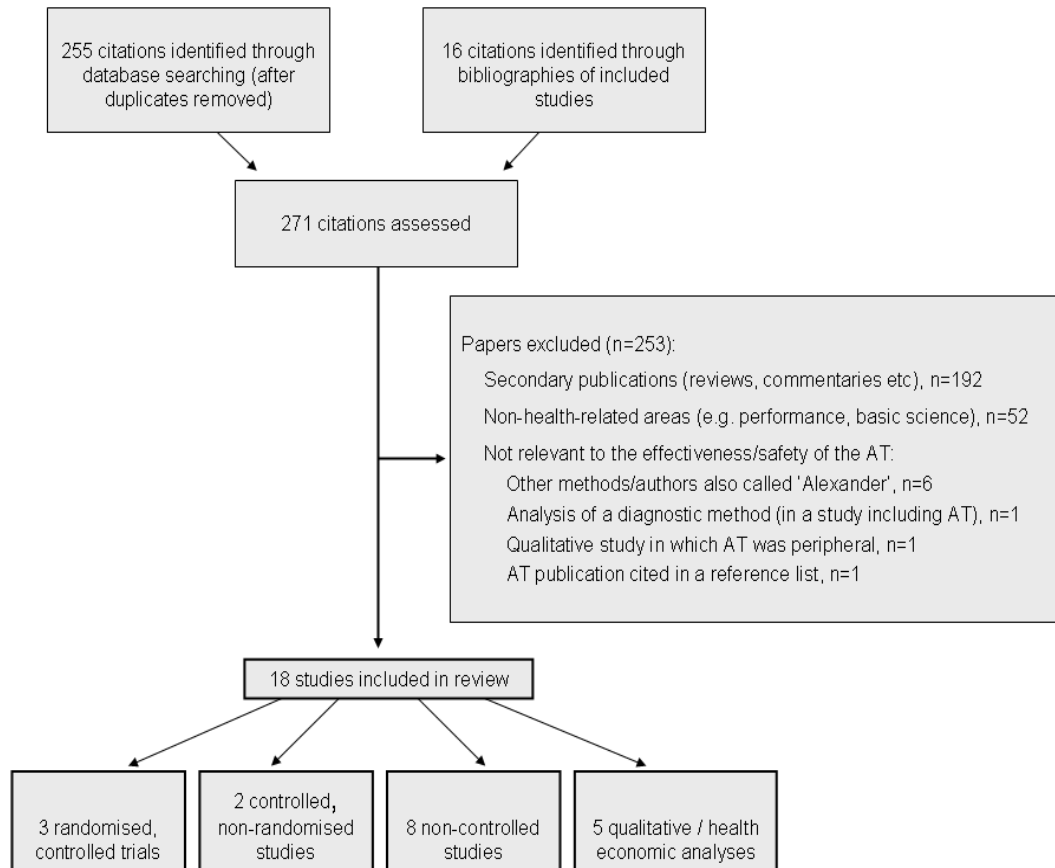


Figure 1. Study selection

Note: three of the qualitative/health economic studies were analyses of one of the RCTs; some of the excluded publications classed under non-health-related areas may also have been secondary publications.

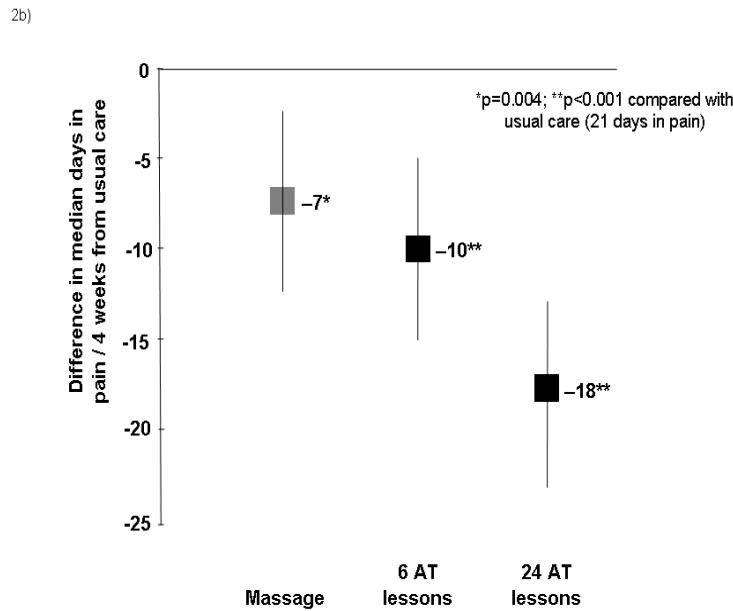
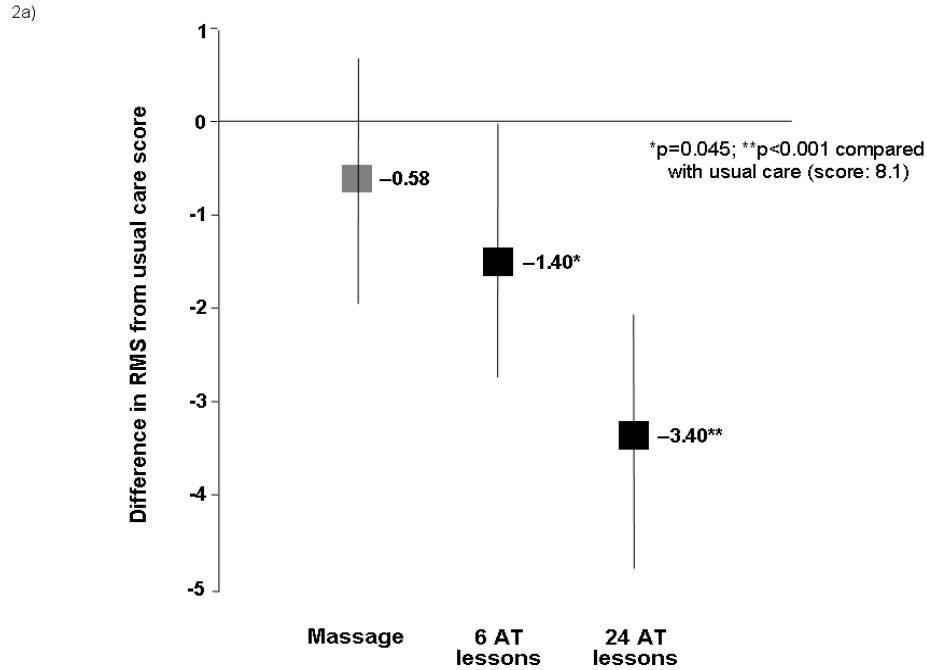


Figure 2. ATEAM trial primary outcomes at 1 year: a) Difference in mean Roland Morris score (RMS) between intervention and control (usual GP care) b) Difference between intervention and control (usual GP care) in median number of days in pain in the last 4 weeks. Figure shows mean/median and 95% confidence intervals and is based on data from Little et al [14].

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Table 1: Randomised controlled trials of effectiveness of AT lessons in different medical conditions.

Area	Study	Design	Jaded score*	No. of participants	Experimental intervention [†]	Control intervention	Outcome measures	Main results
Chronic low back pain	Little et al [14]	RCT with factorial design	4	579	i) 6 AT lessons over 4 weeks [†] ii) 24 AT lessons over 9 months. ^{††} AT lessons delivered by 58 teachers	i) Usual GP care ii) 6 weekly therapeutic massage sessions Massage delivered by 94 massage therapists	Primary: i) Roland Morris disability score (RMS) ii) days in pain in last 4 weeks Secondary: 8 other validated measures (total of 11 measures including sub-scales)	RMS at 1 year: AT groups had significantly less incapacity than the usual care group (difference in RMS score vs usual care was -3.4 for the 24 AT lesson group, p<0.001, and -1.4 for the 6 AT lessons arm, p=0.045). No significant difference for massage group (-0.58 difference vs usual care, p=0.4) Days in pain at 1 year: AT groups had significantly less pain than usual care group (3 days vs 21 days per month, p<0.001 for the 24 AT lessons arm and 11 vs 21 days for the 6 AT lessons arm, p<0.001). Massage group also significant difference with 14 vs 21 days (p=0.004) Secondary measures at 1 year: 24 AT group had significantly better scores than usual care on 10/11 sub-scales (p<0.01); 6 AT group was significantly better on 5/11 (p<0.05) and massage on 4/11 subscales (p<0.05)
	Vickers et al [15]	RCT with three parallel arms	3	91	20 AT lessons (2/week for 10 weeks) delivered by one teacher	i) 10 weekly self-help group meetings (total time equivalent to experimental intervention arm) ii) Usual care	Visual analogue pain scale (VAS), raw pain score (RPS), disability score (DS), inappropriate-pain behaviour (IPB)	Post-intervention: Significantly lower disability and pain in AT arm compared with other arms (DS: p<0.001, VAS: p=0.05, IPD p<0.001). At 6 months DS was significantly lower for the AT arm (p=0.005), VAS and RPS were numerically but not significantly lower. 12 months' follow-up was only for VAS and RPS; both were numerically but not significantly lower in the AT arm.
Parkinson's disease	Stallibrass et al [22]	RCT with three parallel arms	3	88	24 AT lessons (2/week for 12 weeks) delivered by two teachers	i) 24 massage treatments (2/week for 12 weeks) ii) No additional intervention (usual care)	Primary: Self-assessment Parkinson's disease disability scale (SPDDS) Secondary: Beck Depression Inventory (BDI), Attitude-to-self scale (ASS)	SPDSS (both at best and at worst [‡]) was significantly better in the AT group than usual care post-intervention (p≤0.04), with improvement maintained at 6 month follow-up (p≤0.04). Secondary outcomes were also positive compared with usual care but only significant for BDI post-intervention (p=0.03) and for ASS at 6-month follow-up (p=0.04).

*Modified Jaded scoring system with a maximum possible score of 4 [11]; [†]All AT lessons delivered one-to-one; ^{††}Lesson frequency was two/week for 2 weeks, then one/week for 2 weeks; [‡]Lesson frequency was two/week for 6 weeks, then one/week for 6 weeks, one/fortnight for 8 weeks and one revision lesson at 7 months and at 9 months
RCT: randomised, controlled trial; [‡]SPDDS was measured at best and worst time during a 1-week period.

Table 2: Non-randomised studies of AT intervention in health-related areas.

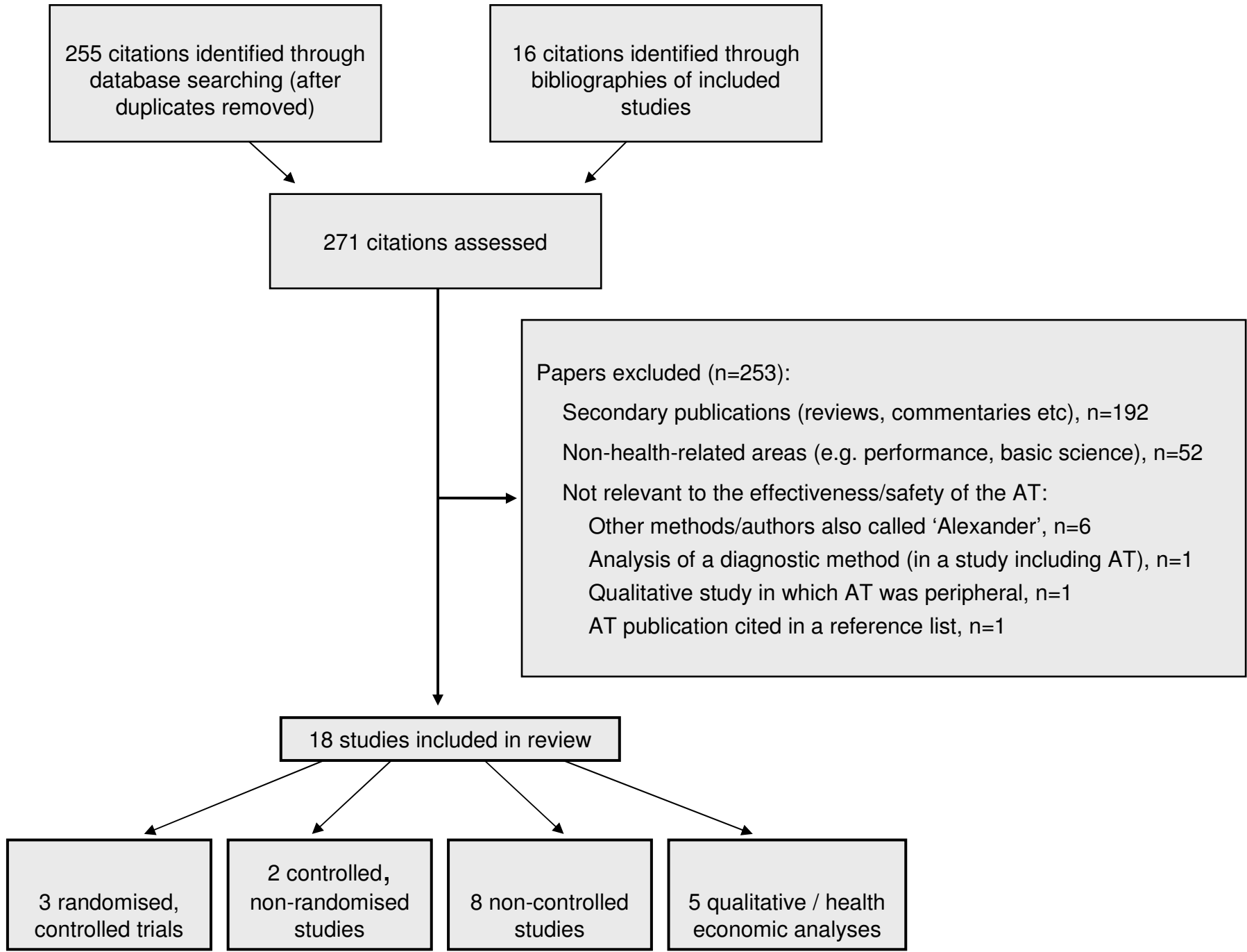
Area	Study	Design	No. of participants	Experimental intervention ⁷	Control intervention	Outcome measures	Main results
Controlled studies							
Balance in the elderly	Dennis [24]	Two parallel arms	13 elderly volunteers (plus 6 in a pilot study)	Group bi-weekly delivery of 8 AT lessons by one teacher	No intervention	Functional reach (FR)	FR increased by 3.8cm compared with control group ($p<0.005$), and by 32% compared with baseline ($p<0.025$)
Respiratory function	Austin and Ausubel [27]	Two parallel arms with matched controls	20 healthy volunteers	20 AT lessons at approximately weekly intervals delivered by eight teachers	No intervention	i) Highest forced expiratory flow measured with peak flow meter (PEF) ii) Maximum voluntary ventilation (MVV) iii) Maximal inspiratory pressure (MIP) iv) Maximal expiratory mouth pressure (MEP), plus 3 other measures	Significant improvement in experimental group on 4 measures: PEF: 9%, $p<0.05$; MVV 6%, $p<0.05$; MIP 12%, $p<0.02$; MEP 9%, $p<0.005$ compared with baseline; but no changes in the other 3 measures. No significant changes in control group for any measure
Non-controlled studies							
Balance in the elderly	Batson and Barker [29]	Single group, pre-test, post-test	19 elderly people with a history of falls	Group delivery of AT in intensive 2-week course by two teachers	No control group	Fullerton Advanced Balance Scale (FAB); Timed 'up and go' (TUG); Modified Falls Efficacy Scale (MFES)	Significant improvement across the group post- vs pre-intervention in FAB ($p=0.05$) and TUG ($p=0.006$). No significant change in overall MFES
Posture and ergonomics	Reddy et al [30]	Single group, pre-test, post-test	8 surgeons	8 AT lessons delivered by two teachers	No control group	Pre- and post-test basic surgical skill assessment and of postural coordination	Significantly higher posture scores post-test for neck, spine, shoulders hands and fingers ($p<0.05$); Significantly greater score post-test in surgical ability assessment ($p\leq 0.02$)
Stuttering	Schulte and Walach [31]	Case reports	2 adults with chronic stuttering	30 AT lessons (2-4/week) delivered by one teacher	No control group	Frequency of stuttering during speech and 17 different variables related to stuttering or application of AT during speaking.	Reduced frequency of stuttering in both participants. Significant improvement in 8 of the 17 measures compared with baseline.
Various	Maitland et al [32]	Case reports	8 adults with learning disabilities	1-27 AT lessons (dependent on individual) delivered by one teacher	No control group	Clinical assessment	Subjective improvements in breathing, mobility and anxiety levels were observed in this exploratory study
Parkinson's disease	Stallibrass [23]	Single group, pre-test, post-test	7 adults with Parkinson's disease	Median 12 AT lessons delivered by several	No control group	i) Beck Depression Inventory (BDI); ii) Activities in daily living (ADL) scale iii) Body concept scale (BACS) iv) Functioning	Significantly better scores post- compared with pre-intervention for BDI ($p<0.01$), ADL and BACS ($p<0.05$). Change in FDQ was positive but not significant

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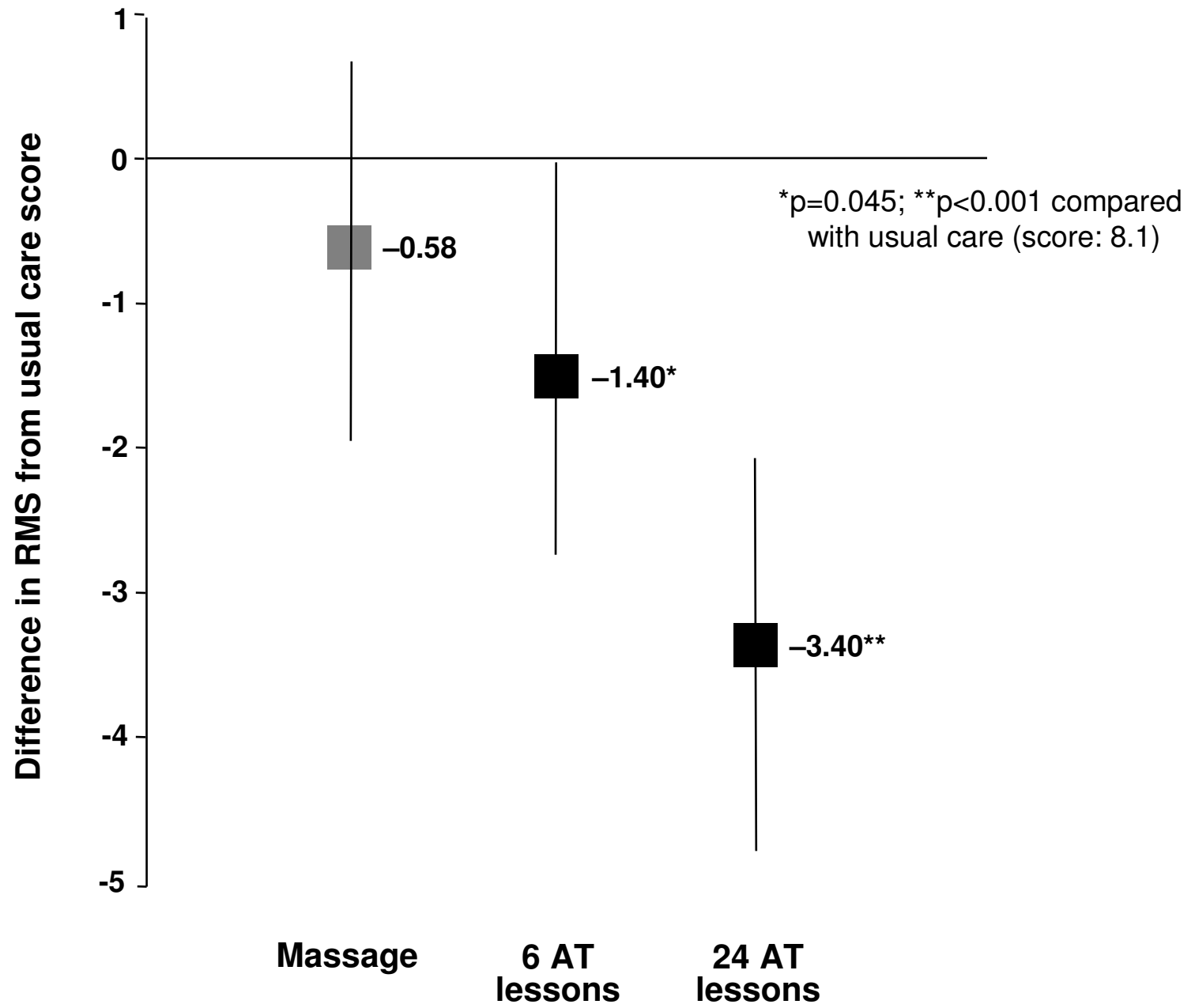
				teachers (number not specified)		Disability questionnaire (FDQ)	
Chronic back pain	Cacciatore et al [7]	Case report	1 adult with chronic back pain	20 AT lessons (~weekly over 6 months) delivered by one teacher	No control group	i) Pain (visual analogue scale [VAS]) ii) Postural coordination (automatic response to surface translations & one-legged balance)	Pain changed from 8.3 on VAS to 1.9 post intervention. Pain changed from daily to 1–2 days per month. Quantitative improvement in postural coordination observed
	Elkayam et al [33]	Single group, pre-test, post-test	67 adults with chronic back pain who had not improved with previous physiotherapy	4-week multi-disciplinary programme including 8 AT lessons	No control group	Pain rating, pain frequency and amount of analgesic use	Significant improvement vs baseline in pain rating and duration maintained at 6 months (p<0.01). Analgesic use reduced from 76% of patients at baseline to 33% at 6 months. However, impossible to evaluate the specific contribution of AT lessons to this outcome
Chronic pain	Fisher [34]	Single group, pre-test, post-test	34 adults with chronic pain (mostly low back)	4-week multi-disciplinary programme including AT lessons	No control group	Pain VAS, General Health questionnaire, Oswestry disability scale, Health Locus of Control	Modest improvement in some measures at 3 months and 1 year compared with baseline (significance not reported) but impossible to evaluate the specific contribution of AT lessons to this outcome

† All AT lessons delivered one-to-one unless otherwise specified (marked as 'group delivery')

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