Therapeutic exercise in physiotherapy practice is beneficial: a summary of systematic reviews 2002–2005

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Question: Is therapeutic exercise of benefit? ***Design:*** A summary of systematic reviews on therapeutic exercise published from 2002 to September 2005. ***Participants:*** People with neurological, musculoskeletal, cardiopulmonary, and other conditions who would be expected to consult a physiotherapist. ***Intervention:*** Therapeutic exercise was defined as the prescription of a physical activity program that involves the client undertaking voluntary muscle contraction and/or body movement with the aim of relieving symptoms, improving function or improving, retaining or slowing deterioration of health. ***Outcome measures:*** Effect of therapeutic exercise in terms of impairment, activity limitations, or participation restriction. ***Results:*** The search yielded 38 systematic reviews of reasonable or good quality. The results provided high level evidence that therapeutic exercise was beneficial for patients across broad areas of physiotherapy practice, including people with conditions such as multiple sclerosis, osteoarthritis of the knee, chronic low back pain, coronary heart disease, chronic heart failure, and chronic obstructive pulmonary disease. Therapeutic exercise was more likely to be effective if it was relatively intense and there were indications that more targeted and individualised exercise programs might be more beneficial than standardised programs. There were few adverse events reported. However, in many areas of practice there was no evidence that one type of exercise was more beneficial than another. ***Conclusion:*** Therapeutic exercise was beneficial for patients across broad areas of physiotherapy practice. Further high quality research is required to determine the effectiveness of therapeutic exercise in emerging areas of practice. **[Taylor NF, Dodd KJ, Shields N, Bruder A (2007) Therapeutic exercise in physiotherapy practice is beneficial: a summary of systematic reviews 2002–2005. *Australian Journal of Physiotherapy* 53: 7–16]**

Key words: Physical Therapy; Exercise Therapy; Therapeutic Exercise; Exercise; Review

Introduction

The analysis and treatment of movement problems is a major focus of physiotherapy practice (Jensen et al 1999). Physiotherapists use a number of approaches to managing movement disorders, and the prescription of exercise is one of the most common. Exercise prescribed by a physiotherapist can target directly any impairments contributing to activity limitations and involves the active participation of patients in their own management.

Exercise can be defined as the prescription of a physical activity program that involves the client undertaking voluntary muscle contraction and/or body movement with the aim of relieving symptoms or improving function, or improving, retaining or slowing deterioration of health (based on Licht 1984). For the purposes of this review therapeutic exercise does not include physical education training, or prevention of disease in people, or body movement for the purposes of assessment.

A recent summary of systematic reviews on the effects of exercise in disorders commonly managed by physiotherapists concluded that exercise was beneficial for people with a range of chronic conditions (Smidt et al 2005). Conclusions based on a systematic review of randomised controlled trials are considered to provide the highest level of evidence about the effectiveness of an intervention (NHMRC 1999). The earlier review of Smidt et al included articles published up until 2002. Given the growth in the numbers of published systematic reviews and randomised controlled trials in physiotherapy since that time, it is necessary to provide clinicians and policy makers with the most up to date evidence about the effectiveness of our interventions. In addition the Smidt et al review did not include reviews on the full diversity of patients managed by physiotherapists. Therefore, the aim of the current review was to complement the review of Smidt et al (2005) by providing an evaluation of the evidence from recent systematic reviews. The research question for this study was:

1. Is therapeutic exercise of benefit in reducing impairment, improving activity, and increasing societal participation for people who would be expected to consult a physiotherapist?

Method

Identification and selection of reviews: The following electronic databases were searched (from 2002 to September 2005) for systematic reviews that evaluated the effects of therapeutic exercise: Medline, Medline in process, CINAHL, EMBASE, AMED, SPORT discus, AUSPORT Med, Cochrane Reviews, DARE, and PEDro. The key words and search terms used to develop the search strategy for each of these databases included: exercise therapy, exercise, therapeutic exercise, rehabilitation exercise, movement therapy, motion therapy, physical therapy, physiotherapy, and kinesiotherapy. These terms were combined with relevant published filters developed to identify systematic reviews (eg, Boynton et al 1998). The electronic searches were supplemented by checking the reference lists of any relevant identified articles.

One reviewer (KD) applied the search strategy to each of

Table 1. Inclusion and exclusion criteria for reviews.

	Inclusion	Exclusion
Participants	Included clients with any of the conditions stated in the text	Included clients with conditions other than those stated in the text
Intervention	Met the operational definition of therapeutic exercise, that: (1) it was prescribed, (2) it comprised voluntary muscle contraction and/or body movement, and (3) the aim of the program was to relieve symptoms, improve function or improve, retain or slow deterioration of health	The therapeutic exercise intervention: (1) was combined with another intervention (for example, surgery and therapeutic exercise, or pharmacology and therapeutic exercise), (2) comprised a single session of exercises, or passive movement without client actively participating, (3) was prescribed to prevent a disease state in an otherwise unimpaired person (for example to prevent cardiac disease), (4) was body movement for the purpose of assessment, or (5) was physical education
Comparison	Therapeutic exercise was compared to: (1) no treatment or a wait and see scenario, (2) another conservative treatment, (3) surgery, or (4) another type of therapeutic exercise program	No comparison made
Outcomes	Any positive or negative outcome for the client as related to (1) impairment, (2) activity limitation, or (3) participation restriction	The outcome of the review was to identify or evaluate (1) barriers or facilitators to therapeutic exercise, (2) factors related to exercise adherence, (3) outcomes for the therapist (for example therapist satisfaction), (4) outcomes for health service or health care system (for example, economic outcomes) or (5) prevention of health condition in an otherwise unimpaired person
Research design	The systematic review (1) had included a transparent and reproducible protocol (at least reporting on inclusion criteria, search dates and databases searched), (2) contained at least 1 RCT, (3) was published in full in a peer reviewed journal or database (eg, Cochrane library), (4) was written in English, and (5) if it contained papers evaluating more than one diagnostic group, the results and conclusions must have been presented separately for each diagnosis	
Quality assessment	The review was of good quality (80–100 points) or reasonable quality (60–79 points) as assessed by criteria developed by Assendelft et al (1995)	The review was of moderate quality (40–59 points), poor quality (20–39 points) or very poor quality (< 20 points) as assessed by criteria developed by Assendelft et al (1995)

the electronic databases and imported the final total yields from each database into a bibliographic software program. Two reviewers (KD and AB) independently screened the titles and abstracts of the articles identified by the search, according to the inclusion/exclusion criteria of the review. Articles that clearly did not fulfil the inclusion criteria were discarded. Potentially-relevant articles were retrieved for full-text assessment when the title and abstract did not provide sufficient information to include or exclude the review. Discrepancies were resolved through discussion between the reviewers.

Systematic reviews were included if they satisfied all of the criteria listed in Table 1 and were published between 2002 and September 2005. Reviews evaluating the effects of therapeutic exercise for people expected to consult a physiotherapist were sought in the following areas of physiotherapy practice: incontinence, postoperative exercise (including orthopaedic, spinal, abdominal, cardiac, and thoracic surgery), mental illness, cardiovascular disease (including vascular and hypertension), renal disease including diabetes, post-transplantation (including renal, hepatic, and lung transplants), hepatic disease, oncology, osteoporosis, spinal cord injury, work related injuries, anterior cruciate reconstruction, Achilles tendinopathy, muscle tears (eg, hamstring muscle tears), joint dislocation (eg, shoulder or patellar dislocation), children with disabilities (eg, cerebral palsy), orthopaedic problems in youth (including shoulder instability, patellofemoral pain, and spondylolisthesis), patellofemoral pain, antenatal and postnatal care, HIV/AIDS, multiple sclerosis, cystic fibrosis, asthma, bronchiectasis, chronic obstructive pulmonary disease, Parkinson's disease, cerebrovascular accident, intermittent claudication,

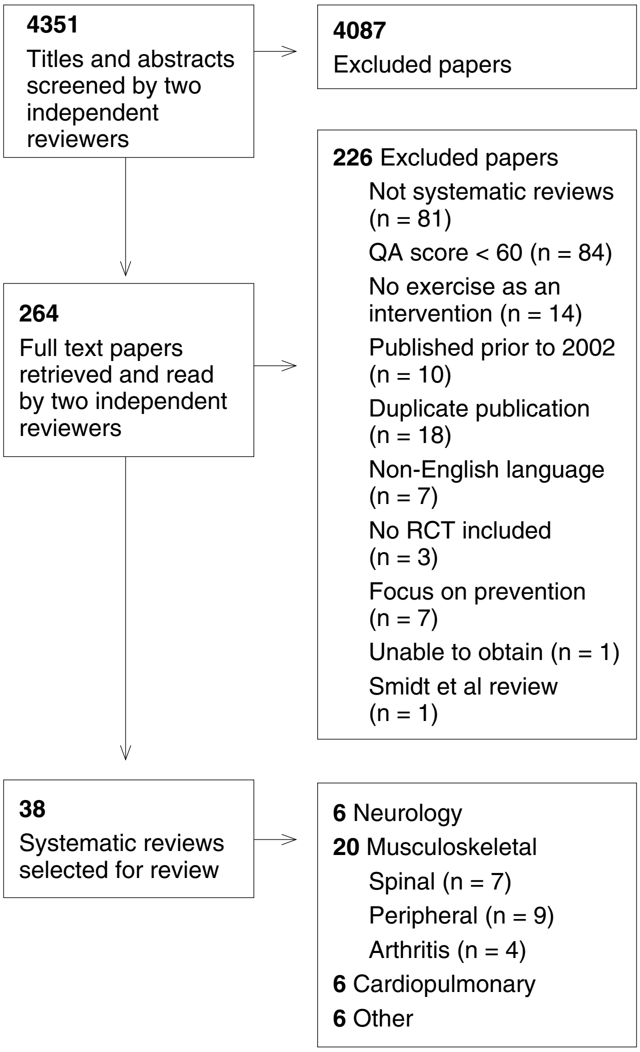

Figure 1. Identification and selection of systematic reviews.

osteoarthritis, ankylosing spondylitis, rheumatoid arthritis, repetitive strain injury, neck pain, shoulder pain and low back pain.

Assessment of quality of reviews: The quality of the included systematic reviews was assessed using a scale developed by Assendelft et al (1995) (Appendix 1 on the eAddenda). The scale comprises 37 items that assess selection of studies, methodological quality of trials, description of interventions, data presentation, and evaluation – with a maximum score of 100 points. Systematic reviews were included only if they were deemed to be of reasonable quality (60–79 points) or good quality (80–100 points of quality) (De Vet et al 2001).

The quality assessment was performed by two reviewers independently (NS and AB). Disagreements between reviewers were resolved through discussion until a consensus was reached. If agreement could not be reached, a third reviewer (NT) adjudicated on the issue.

Data analysis: Data were extracted from each included article using a standardised form developed for the review. Data extraction was completed by one reviewer and then independently checked by a second reviewer. Data were extracted on the following: objective of the systematic review, health condition studied (including details of the participants to which the exercise was applied), number of trials included, research designs of the included trials, number of participants, description of intervention studied (including environmental factors such as details of exercise dosage and implementation), who the comparison or control group were, outcome measures used, positive and negative effects of prescribed exercise, statistical results, and review conclusions.

The articles were classified under one of the following headings: neurology, musculoskeletal (spinal, peripheral, or arthritis), cardiopulmonary, or other areas of practice. All data were synthesised descriptively. The conclusions reported by the included reviews on the effectiveness of therapeutic exercise were documented. A grading system, based on a similar scheme applied by Smidt et al (2005), was used to describe the level of evidence reported in each included review:

++ The systematic review reported that there was strong or clear evidence that therapeutic exercise was effective. For example, there were consistent findings in multiple high quality trials that therapeutic exercise was effective (positive).

+ The systematic review reported that there was moderate or limited evidence that therapeutic exercise was effective; or that there were indications to support the effectiveness of therapeutic exercise. For example, there were consistent findings in multiple low quality trials or one high quality randomised controlled trial (some positive indications that therapeutic exercise may be effective).

0 The systematic review reported that there was insufficient or no evidence to support or refute the effectiveness of therapeutic exercise; or therapeutic exercise was equally as effective as other therapies (equal or insufficient evidence).

– The systematic review reported that therapeutic exercise was harmful or less effective than other therapies (negative).

The grading system was applied to the conclusions reported by each included systematic review. Some reviews based their conclusions on a scale with set criteria for what would determine strong, moderate or limited evidence (eg, van Tulder 1993), while other reviews based their conclusions on a descriptive or qualitative synthesis of the evidence. When more than one systematic review investigated the same patient group, the decision algorithm described by Jadad et al (1997) was applied to come to a conclusion for that patient group. For example, clarifying whether the reviews asked the same question, or contained the same trials could help to resolve apparent discordance in conclusions.

The conclusions for each patient group in the included reviews from 2002 to 2005 were compared to the conclusions from the earlier review on therapeutic exercise (Smidt et al 2005). Final conclusions using the grading system described above were formulated. Where the current review and the Smidt et al (2005) review agreed, or that patient group was only addressed in one of the reviews, then that conclusion was accepted as providing the best current evidence on the effectiveness of therapeutic exercise in that patient group. Where there was discordance between the conclusions of the current review and Smidt et al (2005), the decision algorithm of Jadad et al (1997) was applied to reach a final conclusion.

Results

Identification and selection of reviews: The initial search strategy yielded 4351 articles. After the application of the inclusion, exclusion and quality criteria, 38 systematic reviews were selected for analysis (Fig. 1). See Appendix 1 on the eAddenda for details of the quality scoring of retrieved full text articles that met all other inclusion criteria. No systematic reviews that met the inclusion and quality criteria and were published between 2002 and September 2005 were located in the following areas of physiotherapy practice: post-transplantation (including renal, hepatic, and lung transplants), hepatic disease, work related injuries, Achilles tendinopathy, muscle tears (eg, hamstring muscle tears), joint dislocation (eg, shoulder or patellar dislocation), osteoporosis, incontinence, diabetes, ante-natal care, bronchiectasis, intermittent claudication, repetitive strain injury, and rheumatoid arthritis.

Effect of therapeutic exercise in neurological conditions: The search for systematic reviews on therapeutic exercise in the area of neurological physiotherapy yielded six reviews (see Table 2 on the eAddenda for details of the new reviews). Three systematic reviews described the effects of exercise on adults with stroke (Kwakkel et al 2004, Moseley et al 2005, Saunders et al 2004) and one review described the effects of exercise in each of the following areas: multiple sclerosis (Rietberg et al 2004), peripheral neuropathy (White et al 2004), and cerebral palsy (Dodd et al 2002).

Based on the review of 15 trials (including 11 randomised controlled trials) comprising 622 participants with stroke (Moseley et al 2005), it was concluded that there was insufficient evidence to support or refute the effects of treadmill training on walking function (walking speed, endurance or level of independence). However, for people with stroke who could walk independently, participation in a relatively short treadmill training program (20–60 minutes a day, 3–5 days per week for between 2 and 10 weeks) demonstrated a trend to increased self-selected walking speed. A review of 12 randomised controlled trials and 289 participants with stroke concluded that aerobic exercise programs conducted 30–90 minutes a day for at least three days a week for between 2 and 12 weeks improved maximal walking speed (by a standardised mean difference of 0.42 m/sec) and the level of walking independence (Saunders et al 2004). A review of 20 randomised controlled trials and more than 2600 participants with stroke investigating the effect of increased exercise time found limited evidence that exercise programs focused on improving lower extremity function within the first six months after a stroke and of at least 16 hours longer duration than the comparison group had a positive effect on activities of daily living and walking speed (Kwakkel et al 2004).

In summary, these three systematic reviews provided limited evidence that therapeutic exercise, particularly if of sufficient duration, led to benefits in walking function after stroke but there was insufficient evidence to support or refute the effectiveness of treadmill training.

One review of nine randomised controlled trials comprising 260 participants investigated the effectiveness of therapeutic exercise in the management of multiple sclerosis. The review concluded there was strong evidence that participation in a therapeutic exercise program conducted at least five times a week for four weeks improved muscle strength and mobility of people with multiple sclerosis without acute exacerbation of symptoms (Rietberg et al 2004).

One review of three trials (including one randomised controlled trial) comprising 82 participants investigated the effectiveness of exercise on the management of peripheral neuropathy. The review found limited evidence that progressive resistance exercise focused on strengthening the lower extremities conducted at least three days a week for 24 weeks was effective in reducing the symptoms of muscle weakness and slow walking speed in people with peripheral neuropathy associated with Charcot-Marie-Tooth disease (White et al 2004).

One review on the management of cerebral palsy of 10 trials (only one randomised controlled trial) comprised 126 participants. This review found limited evidence that a progressive resistance strength training program conducted at least three times a week for six weeks improved muscle strength in people with cerebral palsy (Dodd et al 2002).

Effect of therapeutic exercise in musculoskeletal conditions

Arthritis: Reviews on the effect of exercise on arthritis resulted in a yield of four reviews (see Table 3 on the eAddenda for details of the reviews). The reviews concluded there was strong evidence that aerobic or strengthening exercise reduced pain and improved activity level in people with osteoarthritis of the knee (Brosseau et al 2004, Pelland et al 2004). There was insufficient evidence to recommend one form of exercise over another for people with arthritis, but there was moderate level evidence that supervised group exercise programs were more effective than unsupervised individual exercise programs (Brosseau et al 2004, Daginfrud 2004, Pelland et al 2004). A review of six randomised controlled trials comprising 561 participants with ankylosing spondylitis concluded that there was moderate level evidence that exercise reduced pain and improved spinal mobility in this population (Daginfrud 2004).

In summary, there is strong evidence that therapeutic evidence can benefit people with osteoarthritis of the knee, and moderate level evidence that therapeutic evidence can benefit people with ankylosing spondylitis.

Low back pain and neck pain: Reviews on low back and neck pain resulted in a yield of seven reviews (see Table 4 on the eAddenda). Three of these reviews investigated people with low back pain (Hayden et al 2005a, Kool et al 2004, Ostelo et al 2005), one investigated people after lumbar disc surgery (Ostelo et al 2002), and three investigated people with disorders related to the neck (Bronfert et al 2004, Conlin et al 2005, Kay et al 2005).

A review of 61 randomised controlled trials comprising more than 6000 participants concluded there was strong evidence that exercise reduced pain (by 7.3 points on a 0–100 scale, 95% CI 3.7 to 10.9) and improved activity (by 2.5 points, 95% CI 1.0 to 3.9) in people with chronic low back pain (Hayden et al 2005a) Two reviews also found strong evidence that exercise reduced sick leave in people with subacute and chronic low back pain (Hayden et al 2005a, Kool et al 2004). In further analysis of the data reported in Hayden et al (2005a), it was concluded that exercise programs that were individually designed, high dose (defined as more than 20 hours of intervention time), and delivered through a home-based exercise program with regular practitioner follow up were likely to be most effective for people with chronic low back pain (Hayden et al 2005b). Based on 10 randomised controlled trials comprising 1192 participants, there was no evidence that exercise was effective in reducing pain or increasing activity for people with acute low back pain either compared to no treatment or compared to other conservative treatments (Hayden et al 2005a). There was strong evidence that intensive exercise programs, including individualised muscle strengthening exercises for the legs and trunk, starting 4–6 weeks after lumbar disc surgery training 2–3 times a week for 6–8 weeks, improved activity and led to a faster return to work without increased risk of disc herniation or increased rates of re-operation (Ostelo et al 2002).

In summary, therapeutic exercise was effective compared to no treatment in subacute and chronic low back pain and after lumbar disc surgery, but not for patients with acute low back pain.

A review of 31 randomised controlled trials comprising 2802 participants concluded there was strong evidence that, compared to no treatment, neck exercises when combined with manual therapy reduced pain and improved activity in people with subacute and chronic mechanical neck disorders (Kay et al 2005). There was moderate evidence from one high quality randomised controlled trial (Jull et al 2002) that, compared to no treatment, low load endurance exercises to train muscle control in the cervico-thoracic region with 8–12 sessions over 6 weeks reduced headache pain and intensity in people with chronic neck disorders (Bronfert et al 2004, Kay et al 2005). There was limited evidence that neck exercises reduced pain in people with acute whiplash associated disorders (Conlin et al 2005, Kay et al 2005). In the management of mechanical neck disorders, there was no evidence that one type of exercise was better than another or that exercise was superior to other interventions such as manual therapy (Kay et al 2005). In summary, there was strong evidence that therapeutic exercise when combined with manual therapy can benefit people with mechanical neck disorders, and moderate or limited evidence that therapeutic exercise can benefit people with neck-related headaches and whiplash associated disorders.

There were nine reviews on peripheral musculoskeletal conditions (see Table 5 on the eAddenda for details of the reviews). Three of these reviews investigated the rehabilitation of people after fracture (Handoll et al 2002, Handoll et al 2003, Handoll et al 2004), three reviews investigated people with musculoskeletal disorders of the upper limb (Green et al 2005, Smidt et al 2003, Thien et al 2004), and three reviews investigated people with musculoskeletal disorders of the lower limb (Heintjes et al 2003, Trees et al 2005, van Os et al 2005).

Fractures: A review of eight trials (including seven randomised controlled trials) comprising 580 participants concluded there was limited evidence that targeted exercise interventions after hip fracture such as progressive resistance exercise (Hauer et al 2002) or treadmill training (Baker et al 1991) led to some short term reductions in impairment and improvement in activity (Handoll et al 2004). There was limited evidence that exercise commenced within one week after non-displaced or minimally-displaced fracture of the proximal humerus was more effective in reducing pain and improving activity in the short-term than delayed exercise (Handoll et al 2003). There was limited evidence that patients with fracture of the proximal humerus did just as well with prescribed home exercise with occasional therapist review compared with supervised physiotherapy (Handoll et al 2003). There was insufficient evidence in a review of six randomised controlled trials and 419 participants to determine whether exercise delivered as part of supervised therapy was more beneficial for people after wrist fracture than exercises prescribed to be completed as a home program (Handoll et al 2002).

In summary, there was limited evidence that therapeutic exercise was of benefit to people after fracture of the neck of femur and fracture of the neck of humerus, but insufficient evidence to determine whether therapeutic exercise was beneficial after wrist fracture.

Musculoskeletal disorders of the lower limb: A review of 12 trials (including nine randomised controlled trials) comprising almost 700 participants with patellofemoral pain syndrome concluded there was limited evidence that quadriceps exercise reduced knee pain and improved activity in this population, but there was no evidence that one form of exercise was superior to another, such as open or closed kinetic chain exercise (Heintjes et al 2003). Based on nine trials (including seven randomised controlled trials) comprising 391 participants, there was no evidence to support one form of exercise over another in the rehabilitation of people with an injury to the anterior cruciate ligament (Trees et al 2005). There was limited evidence that supervised exercises emphasising balance training commenced in the first few days after ankle sprain reduced impairments of pain and swelling, and led to faster return to work and reduced rates of re-injury (van Os et al 2005).

Musculoskeletal disorders of the upper limb: Based on two randomised controlled trials comprising 191 participants that compared exercise to no treatment, it was reported there was moderate evidence that exercises reduced short-term impairments (pain and decreased range of motion) in people with shoulder pain and improved activity, both short- and long-term (Green et al 2003). There was insufficient evidence from a single randomised controlled trial with 19 participants to conclude that exercise involving stretching, and muscle training was more beneficial than ultrasound and friction massage in reducing pain in people with lateral epicondylitis of the elbow (Smidt et al 2003). There was no evidence from a review that included five randomised controlled trials comprising 413 participants that one type of exercise protocol was better than another in leading to increased range of motion, improved activity, and reduced complication rates after surgery for flexor tendon injuries of the hand (Thien et al 2004).

Effect of therapeutic exercise in cardiopulmonary conditions

The search for systematic reviews on exercise prescription in the area of cardiopulmonary physiotherapy yielded one review in each of the following areas: heart failure, coronary heat disease, asthma, chronic obstructive pulmonary disease, hypertension, and cervical spinal cord injury (see Table 6 on the eAddenda for details of the reviews).

Table 8. Summary conclusions on effectiveness of therapeutic exercise based on good or reasonable quality systematic reviews by health or condition (number of reviews on which conclusion based in parentheses).

Health or condition	2002–2005	1965–2002 (Smidt et al 2005)	Conclusion
Stroke	+ (3)	+ (3)	+
Multiple sclerosis	++ (1)	–	++
Cerebral palsy	+ (1)	–	+
Peripheral neuropathy	+ (1)	–	+
Parkinson's disease	–	+ (3)	+
Osteoarthritis	++ (3)	++ (3)	++
Ankylosing spondylitis	+ (1)	+ (1)	+
Rheumatoid arthritis	–	0 (1)	0
Low back pain	++ (3)	++ (10)	++ (chronic and subacute low back pain) 0 (acute low back pain)
Lumbar disc surgery	++ (1)	–	++
Neck pain	++ (1)	0 (6)	++
Whiplash associated disorders	+ (1)	–	+
Cervicogenic headaches	+ (1)	–	+
Fractures	+ (4)	–	+
Shoulder pain	+ (1)	0 (3)	+
Patellofemoral pain syndrome	+ (1)	–	+
Lateral epicondylitis	0 (1)	–	0
Ankle sprain	+ (1)	–	+
Flexor tendon injuries	0 (1)	–	0
Repetitive strain injury	–	0 (1)	0
Chronic heart failure	++ (1)	–	++
Coronary heart disease	++ (1)	–	++
Hypertension	++ (1)	–	++
COPD	++ (1)	++ (5)	++
Asthma	0 (1)	0 (1)	0
Spinal cord injury	0 (1)	–	0
Intermittent claudication	–	++ (4)	++
Bronchiectasis	–	0 (1)	0
Cystic fibrosis	–	+ (3)	+
Adults with Down syndrome	+ (1)	–	+
Older adults	+ (1)	–	+
HIV	+ (3)	–	+
Surgery for breast cancer	0 (1)	–	0

HIV = human immunodeficiency virus, COPD = chronic obstructive pulmonary disease, PF = patellofemoral, ++ = strong or clear evidence that therapeutic exercise was effective, + = moderate or limited evidence that therapeutic exercise was effective or that there were indications to support the effectiveness of therapeutic exercise, 0 = insufficient evidence to support or refute the effectiveness of therapeutic exercise or therapeutic exercise was equally effective as other therapies, – = no systematic reviews of reasonable or good quality included for this time or were not the topic of the review

Based on 29 randomised controlled trials comprising 1126 participants, there was strong evidence that aerobic exercise training performed for 40–60 minutes, 3 times a week for 8–16 weeks for males with stable chronic heart failure led to reduced mortality and improved exercise capacity (Rees et al 2004).

There was strong evidence that aerobic exercise training performed for 30–90 minutes, 2–5 days per week for 12–24 weeks led to reduced mortality for people with coronary heart disease (Taylor et al 2004).

A meta-analysis of 15 randomised controlled trials comprising 872 participants found moderate level evidence of a reduction in both systolic and diastolic blood pressure in people with hypertension when they performed aerobic exercise for 20–60 minutes, at least 3 times a week for 3–26 weeks (Whelton et al 2002).

There was strong evidence from a review of 20 randomised controlled trials and 979 participants that people with chronic obstructive pulmonary disease who performed upper and lower extremity exercises of 6–52 weeks duration improved their exercise capacity and experienced less shortness of breath (Salman et al 2003).

There was insufficient evidence from a review of seven trials (including six randomised controlled trials) comprising 292 participants to confirm or refute whether breathing retraining programs benefited patients with asthma (Holloway and Ram 2004).

There was insufficient evidence from a review of three trials (including two randomised controlled trials) comprising 82 participants to support or refute whether inspiratory muscle retraining programs benefited patients with cervical spinal cord injury (Brooks and O'Brien 2005).

Effect of therapeutic exercise in other areas of physiotherapy practice

The search for systematic reviews on exercise prescription in the other areas of physiotherapy yielded three reviews on adults with HIV infection, and one review in each of the following areas: after surgery for breast cancer, adults with Down syndrome, and older adults with health problems (see Table 7 on the eAddenda for details of the reviews).

A review of seven randomised controlled trials comprising 294 participants concluded there was limited evidence that strength training of 2–3 sets of 8–10 repetitions of exercises for both the upper and lower body at 60–90% one repetition maximum, performed 3 times per week for 6–16 weeks, increased mean body weight for adults with HIV infection (O'Brien et al 2004a). There was also limited evidence that aerobic exercise, evaluated in two reviews of 10 randomised controlled trials comprising 276 participants, for at least 20 minutes, 3 times per week for at least 4 weeks at an intensity of 65–85% HR_{max}, 60–85% VO_{2max}, or 50–80% heart rate reserve appeared to be safe and led to reduced depressive symptoms in adults with HIV infection (Nixon et al 2005, O'Brien et al 2004b). In summary, there was limited evidence that strength and aerobic exercise benefited adults with HIV infection.

Based on a review of 12 randomised controlled trials comprising more than 1200 participants, it was concluded that delaying the introduction of exercise in female patients who had surgery for primary breast cancer for between five and 14 days reduced the incidence on seroma formation, but the effect of this on shoulder range of movement and function was unknown (Shamley et al 2005).

A small review of two randomised controlled trials comprising 30 participants found limited evidence that aerobic exercise performed for 25–30 minutes at 65–89% peak heart rate, 3 times a week for 10–16 weeks improved the work performance but not cardiovascular parameters (such as peak oxygen consumption, peak heart rate, and pulmonary ventilation) of adults with Down syndrome (Andriolo et al 2005).

One review, including 28 randomised or quasi-randomised clinical trials, found strong evidence that progressive resistance training completed at least three times per week for at least eight weeks increased muscle strength in older adults with a specific health problem (SMD 0.66, 95% CI 0.38 to 0.93) and older adults with functional limitations (SMD 0.36, 95% CI 0.11 to 0.6) who were living in either an institution or in the community (Latham et al 2003). There was also moderate level evidence that these programs improved the distance walked in six minutes in this population (WMD 53.69 m, 95% CI 27.03 to 80.36) (Latham et al 2003).

Summary of effect of therapeutic exercise

A summary of the effect of therapeutic exercise by health condition can be viewed in Table 8. Taking into account the summary of reviews up until 2002 (Smidt et al 2005), there is strong evidence that therapeutic exercise was effective for patients with multiple sclerosis, osteoarthritis, subacute and chronic low back pain, chronic heart failure, coronary heart disease, chronic obstructive pulmonary disease, intermittent claudication, and after lumbar disc surgery. There were also indications with limited or moderate level evidence that therapeutic exercise was effective for patients with cerebrovascular accident, cerebral palsy, peripheral neuropathy, Parkinson's disease, ankylosing spondylitis, neck pain, whiplash associated disorders, cervicogenic headaches, fractures, shoulder pain, patellofemoral pain, ankle sprains, hypertension, Down syndrome, older adults with health problems, and HIV.

The conclusions of reviews from the period 2002–2005 led to upgraded evaluations of the evidence on the effectiveness of therapeutic exercise for patients with neck pain, and shoulder pain. Smidt et al (2005) in a summary of six systematic reviews concluded that there was insufficient evidence to support or refute the effectiveness of therapeutic exercises for people with non-specific neck pain. One explanation for the discordance in conclusions between Smidt et al and the current review is that the current review included many randomised controlled trials published since the Smidt review. For example, the review of Kay et al (2005) in the current review was based on 31 randomised controlled trials. In comparison, the review with the greatest number of included trials in the Smidt summary (Aker et al 1996) was based on only 13 randomised controlled trials. The addition of these more recent trials with larger sample sizes allowed Kay et al (2005) to look at subgroups with neck pain. In summary, there is moderate level evidence that therapeutic exercise can benefit people with neck pain.

For shoulder pain, Smidt et al (2005) concluded there was insufficient evidence to support or refute the effectiveness of therapeutic exercise. The systematic reviews evaluated by Smidt et al (2005) did not include the randomised controlled trials that led to the conclusion of limited evidence for exercise for people with shoulder pain in the current review (Brox et al 1993; Brox et al 1999; Ginn et al 1997). In summary, there is limited evidence that therapeutic exercise can benefit people with shoulder pain.

Discussion

Evidence from 38 reasonable to good quality systematic reviews published in the years 2002–2005 has demonstrated strong evidence that therapeutic exercise can benefit people across broad areas of physiotherapy practice. These results build on and update the evidence of Smidt et al (2005) from which it was concluded that exercise was beneficial for people with a range of chronic disorders. The results of the current review complement the findings of Smidt et al (2005) in two ways. First, it incorporates the new evidence about the effectiveness of therapeutic exercise; in just three years 38 relevant reviews were identified compared to 45 reviews in the time up to 2002. Second, the information from the new reviews on therapeutic exercise provided evidence about many patient health conditions relevant to physiotherapy practice that were not available at the time of the Smidt et al (2005) review.

The exercise interventions that led to improvements were diverse but one unifying theme was that effective exercise programs tended to be intensive. The programs that led to improvements in people with multiple sclerosis, coronary heart disease, and chronic obstructive pulmonary disease involved participants exercising four to five times a week at a relatively high intensity. This theme of sufficient intensity was also replicated in the musculoskeletal literature, where there was evidence that it was the intensive programs that led to success with people with chronic back pain and for people recovering after lumbar disc surgery. Part of the variability reported in the conclusions of the current review for different health conditions may be due not to the effect of therapeutic exercise on that condition but to the choice of an exercise program of sufficient intensity that is targeted appropriately in the included trials, ie, to the quality of the intervention (Herbert and Bo 2005).

Relatively few adverse events were reported from participation in a therapeutic exercise program. This could be partly a reporting issue since trials and the reviews did not always highlight this important outcome. However, when adverse events were reported, typically they were benign and of short duration, such as transient muscle soreness. Physiotherapists in clinical practice might be understandably cautious in prescribing intensive exercises for fear of exacerbating symptoms. However, there was no evidence in this summary of reviews that exercise caused exacerbations of symptoms such as increased fatigue in people with multiple sclerosis, that resistance exercise increased spasticity in people with stroke, or that intensive exercise started four to six weeks after lumbar disc surgery led to greater rates of disc re-herniation.

There were also some indications from this review that exercise may be more effective when it is individualised or targeted. Systematic reviews on exercise after hip fracture surgery, and for people with chronic low back pain concluded that individualised exercises were more effective than standardised exercise programs, where every patient and client is given the same exercise regime. This finding may be significant for health professionals such as physiotherapists who have knowledge about pathology and exercise prescription, as well as the clinical reasoning skills to provide optimal individualised therapeutic exercise.

Another theme that emerged was that results were more favourable when exercise was compared to a no treatment control group. The types of exercises that led to benefits included aerobic exercises, strengthening exercises, and skill training exercises such as balance training exercises. In many areas of practice there was a lack of evidence that one particular type of exercise was superior to another. For example, in the management of patellofemoral pain syndrome, there was no evidence that closed kinetic chain exercises (such as step downs) were superior to open kinetic chain exercises (such as straight leg raises) despite clinical convictions that closed kinetic chain exercises should be emphasised (Brukner and Khan 2002). Similar outcomes were also observed for osteoarthritis of the knee, after fracture, and after anterior cruciate ligament injury when different types of exercise were compared.

A limitation of this summary of systematic reviews was that the conclusions were dependent on the quality of the included systematic reviews, which in turn were dependent on the quality of the trials included in the systematic reviews. We only included systematic reviews of reasonable to good quality. However, it was commonly noted in the reviews that included trials lacked quality. For example, in one of the reviews on stroke (Saunders et al 2004), the overall methodological quality of the trials was rated as low, with only two of the 12 trials describing the random allocation procedure adequately, and only six of the trials using a blinded assessor. Quality matters because the findings of trials with low quality are more likely to be subject to bias. Especially in emerging areas of physiotherapy practice, such as exercise for depression and exercise for cancer, more high quality randomised controlled trials are required to provide better evidence about the effectiveness of therapeutic exercise as a useful intervention. In addition, high quality systematic reviews containing randomised controlled trials on exercise were not located in a number of areas of practice such as after organ transplantation, Achilles tendinopathy, and for antenatal and postnatal care.

Another limitation of this summary of systematic reviews was with the scale used to assess review quality (Assendelft et al 1995). Different weights were assigned to different quality criteria and then summed, which is essentially an arbitrary practice. It is now considered best to use individual components of quality rather than summary scores (Khan et al 2001). In addition, an arbitrary cut-off was applied to determine which reviews were deemed to be of reasonable or good quality. The disadvantage of this approach to assessing quality was that it is possible that the best reviews in determining the value of therapeutic exercise may not have been included for review. The advantage of using our quality assessment scale was that it allowed comparison with the review of Smidt et al (2005) that used a similar scale.

Our review also limited the search to the years 2002–2005, even on topics not covered in the earlier review of Smidt et al (2005). This meant that it is possible that some reviews on areas of practice relevant to physiotherapy may not have been included if there were no reviews on a particular topic since 2002. However, where we located reviews on these topics, they most probably incorporated the information from previous reviews.

In conclusion, prescription of exercise is a core skill of physiotherapists that unifies three of the major dimensions of physiotherapy practice (Jensen et al 1999): management of disorders of movement, knowledge of exercise regimens and dosages, and clinical reasoning skills to ensure that exercises are optimal for the individual. This summary of systematic reviews provides evidence that therapeutic exercise is effective across a diverse range of physiotherapy practice.

eAddenda: Tables 2–7 and Appendix 1, available at www.physiotherapy.asn.au/AJP

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