Interventions for enhancing adherence with physiotherapy: a systematic review

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ABSTRACT

Poor adherence to treatment is commonplace and may adversely affect outcomes, efficiency and healthcare cost. The aim of this systematic review was to identify strategies to improve adherence with musculoskeletal outpatient treatment. Five suitable studies were identified which provided moderate evidence that a motivational cognitive-behavioural programme can improve attendance at exercise-based clinic sessions. There was conflicting evidence that adherence interventions increase short-term adherence with exercise. There was strong evidence that adherence strategies are not effective at improving long-term adherence with home exercise. Due to the multi-dimensional nature of non-adherence, the strategies to improve adherence with physiotherapy treatment are likely to be broad in spectrum. Combined interventions may be effective at promoting adherence with clinic appointments and exercise, though further research would be required to confirm this. Further research to increase basic understanding of the factors which act as a barrier to adherence could facilitate development of strategies to overcome non-adherence.

INTRODUCTION

Recent reviews have concluded that conservative interventions such as manual therapy, education, advice and exercise are effective ways of managing a variety of musculoskeletal conditions including back pain (Airaksinen et al., 2006), neck pain (Hurwitz et al., 2008) and hip and knee pain (Zhang et al., 2008)). However, randomised controlled trials (RCTs) often indicate that the effect size of these interventions is small (Dziedzic et al., 2005; Roddy et al., 2005; Ferreira et al., 2007). These small effect sizes may, in part, be related to non-adherence with treatment, rather than poor treatment efficacy (Gohner and Schlicht, 2006) since adherence with treatment may influence the outcome of that treatment (Vermeire et al., 2001; Hayden et al., 2005).

Adherence has been defined as "the extent to which a person's behaviour…. corresponds with agreed recommendations from a healthcare provider" (WHO, 2003). Poor adherence to treatment has been identified as a problem across a number of healthcare disciplines including physiotherapy (Vasey, 1990; Friedrich et al., 1998; Campbell et al., 2001). Within physiotherapy, the concept of adherence is multi-dimensional (Kolt et al., 2007) and could relate to attendance at appointments, following advice or undertaking prescribed exercises. Studies suggest that non-adherence with treatment regimen and exercise performance could be as high as 70% (Sluijs et al., 1993) and may be particularly poor for unsupervised home exercise programmes (Reilly et al., 1989; Nelson et al., 1995). Another study found that around 14% of physiotherapy patients did not return for follow-up outpatient appointments (Vasey, 1990). Given the potential impact of non-adherence on treatment outcome, strategies which aim to optimise treatment adherence are required for clinical practice.

The aim of this systematic review is to identify strategies used to improve adherence with musculoskeletal outpatient treatment.

METHODS

Guidelines developed by the Cochrane Collaboration Back Review Group were used to design, conduct and report this systematic review (van Tulder et al., 2003).

Data sources & search strategy

The following databases were searched from their inception to December 2009: AMED, CINAHL, EMBASE, MEDLINE, PUBMED, PSYCINFO, SPORTDISCUSS, the Cochrane Central Register of Controlled Trials (CENTRAL) and the physiotherapy-specific resource PEDro. The following key words were used; 'barriers', 'adherence', 'compliance', 'concordance', 'co-operation', 'partnership', ' engagement', 'support group', 'diaries', 'positive feedback', 'mentoring', 'telephone calls', 'reminders', 'follow-up contact' 'group therapy', 'incentives', 'education', 'advice', 'management strategies', 'reward', 'punishment', 'verbal instruction', 'written instruction', 'counselling', 'patient contracts', 'action plans', 'coping plan', 'goal setting', 'positive reinforcement', 'patient expectations', family support', 'partner involvement', therapy', 'motivational programmes', 'self-efficacy', 'therapeutic alliance', 'therapeutic relationship', 'physical', 'physiotherapy', 'osteopath', 'chiropractor', 'multidisciplinary team', 'sports', 'pain', 'joint', 'muscle', 'musculoskeletal', 'outpatients'. The references of primary studies identified were scanned to identify further relevant citations. Internet searches of Google and Google Scholar were conducted.

Study selection

Studies were included if they: (1) were RCTs which were peer-reviewed and published in the English language, (2) investigated symptomatic adults with mechanical musculoskeletal dysfunctions of an acute, chronic or post-operative nature, (3) investigated interventions to improve adherence to treatment and (4) investigated interventions administered mainly by physical or exercise therapists.

Studies were excluded if they investigated asymptomatic or in-patient populations, patients with life threatening conditions/reduced mortality, non-musculoskeletal conditions or systemic musculoskeletal conditions being managed primarily by drug therapy or multidisciplinary team approaches.

Following the initial search, a three phase screening strategy was used to identify relevant articles. Initially, two investigators (MB & LB) independently screened potentially relevant studies based on a review of their titles and abstracts. Secondly, remaining citations were examined independently by the two investigators and agreement reached on articles which did not meet the selection criteria. Finally, both

investigators independently reviewed the full text of remaining articles against the selection criteria and consensus was reached for their final inclusion in the review. In the event of disagreement a third reviewer (SM) was asked to arbitrate.

Quality assessment of studies

Two reviewers (SM & CL) independently assessed the methodological quality and score of each included study. Studies were assessed using the quality assessment tool shown in Table 1 (van Tulder et al., 2003). Each quality item was rated against pre-set standards. Each item is scored as yes (=1), no (=0) or don't know (=0). The overall quality score for each study was calculated by summing the scores of each item (Verhagen et al., 2008). In the event of disagreement a third reviewer (MB) was available, though this was not required. Trials with scores of 6 or more were regarded as high quality (Damen et al., 2006).

Data extraction and synthesis

Two independent reviewers (SM and CL) used a standardised form to extract data regarding the study population, inclusion and exclusion criteria, follow up period, drop-out rates, interventions, outcome measures and data analysis. Whilst a third reviewer (MB) was available to deal with disagreements, mediation was not required.

The inter-rater agreement of quality assessment was determined by calculating percentage agreement and a kappa (κ) co-efficient (Streiner and Norman, 2003).

Due to a lack of homogeneity within the studies a qualitative analysis was conducted. Extracted information is presented in table format. Narrative summaries describe the range of strategies used and their effectiveness at promoting adherence to treatment. Qualitative conclusions in this review were based on levels of evidence developed by the Cochrane Collaboration Back Review Group (van Tulder et al., 2003) (see Table 2). Results were considered consistent if 75% or more of the studies reported similar results on the same outcome measure (Damen et al., 2006).

RESULTS

Study selection

The flow chart (Figure 1) shows the results of study selection. Initial searching identified 296 citations. Following the first screening, 273 articles were excluded and 23 citations retained for the second screening. Using inclusion and exclusion criteria a further 10 articles were excluded. Of the remaining 13 articles, the reviewers agreed on the inclusion of four studies, the exclusion of one study and disagreed on three. Following arbitration by the third reviewer (SMc) two articles were included in the review and one was rejected. In total, six articles reporting on five independent cohorts were selected for the review. Details of excluded studies are available from the corresponding author.

Methodological quality

The reviewers scored 66 items and agreed on 53 items (80.3% agreement). The overall inter-rater agreement (k=0.61) represents good agreement between the reviewers (Altman, 1991). Disagreements mainly related to reading errors or interpretation of the quality criteria list. All disagreements were easily resolved. The results of the quality assessment are shown in Table 3. Articles relating to the same cohort (e.g. Friedrich et al., 1998; 2005) had their quality scores combined to prevent biases in assessing the level of evidence. The quality scores ranged from three to seven, therefore two papers were of low quality (Schneiders et al., 1998; Lysack et al., 2005) and three were of high quality (Friedrich et al., 1998; Friedrich et al., 2005; Gohner and Schlicht, 2006; Basler et al., 2007). The main weaknesses in these studies related to randomisation (items A and B). Although all studies were RCTs the methods of randomisation and whether allocation had been concealed were not always clearly described, therefore the introduction of bias is possible. Blinding of patients (item D) and therapists (item E) usually did not occur, but this is often difficult to achieve in pragmatic studies of this nature. Assessor blinding (item F) was not reported in the two low quality studies (Schneiders et al., 1998; Lysack et al., 2005; Gohner and Schlicht, 2006) raising the possibility of assessor bias.

Study characteristics

The main characteristics of the five studies are shown in Table 4. Three studies recruited patients with chronic low back pain (LBP) (Friedrich et al., 1998, 2005; Gohner and Schlicht, 2006; Basler et al., 2007), one recruited patients with acute or sub-acute LBP (Schneiders et al., 1998) and one recruited inpatients following total hip or

knee replacement (THR/TKR) who were followed up as outpatients (Lysack et al., 2005). Patients were managed in primary care (Schneiders et al., 1998; Gohner and Schlicht, 2006), secondary care (Friedrich et al., 1998, 2005; Basler et al., 2007) and tertiary care environments (Lysack et al., 2005). The sample sizes ranged from n=40 (Lysack et al., 2005) to n=170 (Basler et al., 2007). All studies had acceptable levels of drop-out i.e. <20% on short-term follow up or <30% on long term follow-up (1year).

Interventions

The studies are grouped into two main adherence interventions: (1) use of supporting materials and (2) cognitive-behavioural (CB) interventions.

Supporting material

Two low quality studies (Schneiders et al., 1998; Lysack et al., 2005) investigated the effectiveness of supporting materials.

Schneiders et al. (1998) used written and illustrated exercise instructions to reinforce physiotherapist verbal instructions and demonstrations of exercises for patients with acute and sub-acute LBP. Short-term adherence to exercise over a two week period was found to be significantly better ($p<0.001$) in those patients receiving written instructions than those receiving verbal instructions alone. However a significantly greater percentage of patients in the group receiving supporting literature (84.8%) expected exercise as treatment compared with the control group (50.0%). The authors identified that patients who expected exercise had significantly higher adherence rates with exercise than those who did not. This expectation of exercise, rather than the provision of written literature, could account for greater adherence within the group receiving written instructions. This study therefore provides limited evidence to support the use of written and illustrated exercise instruction to increase adherence with exercise.

Lysack et al. (2005) found that an individualised computer generated exercise video was no more effective than a standardised in-patient rehabilitation package at increasing short term adherence with home exercise in patients following THR/TKR. Both groups reported high levels of adherence with treatment. The in-patient rehabilitation received by all patients was a daily package consisting of 30 minutes of physiotherapy, 30 minutes of occupational therapy and two 1 hour group exercise classes. This level of

daily rehabilitation is considered more intensive than usual for an in-patient orthopaedic setting and may have promoted the high levels of adherence to exercise seen in both groups. Additionally, patient commitment to rehabilitation following post-operative procedures may be higher compared with those experiencing longer term conditions e.g. LBP. This study provides limited evidence of no effectiveness for an individualised exercise video to increase adherence with exercise.

Cognitive-behavioural interventions

Three high quality studies investigated the effectiveness of CB interventions to improve adherence with exercise (Friedrich et al., 1998, 2005; Gohner and Schlicht, 2006; Basler et al., 2007).

Basler et al. (2007) compared a 10 minute counselling session prior to exercise with exercise alone. The counselling sessions were delivered by physiotherapists who had received training about the trans-theoretical model of counselling. Compared with baseline levels of activity, patients in both groups were significantly more adherent with home exercise post-intervention and at 6 month follow-up, however there were no significant differences in adherence between the two groups Based on the results of this study there is evidence of no effectiveness for counselling strategies to increase either short-term or long-term adherence with exercise.

Gohner and Schlicht (2006) compared a CB training programme to reinforce an exercise programme compared with the exercise programme alone. Although delivered by a psychologist, the authors reported that the programme could also be conducted by a physiotherapist. Whilst both groups significantly increased their exercise behaviour compared with baseline, there was a significant difference between the groups at 3 month follow-up ($p=0.009$) favouring the CB group, but this was not apparent immediately post-treatment or at nine months follow-up. This study provides evidence that CB training may be effective at increasing short-term adherence with home exercise. However there is evidence for no effectiveness at increasing long-term adherence with exercise.

Friedrich et al. (1998; 2005) found that subjects receiving a motivation programme to promote adherence significantly increased attendance with exercise based clinic

sessions compared with subjects who did not receive motivation training (p=0.0005). Both groups maintained a reasonable level of short-term and long-term adherence to home exercise but there was no significant difference in adherence between the two groups at 4 months, 1 year or 5 year follow-up. This study provides evidence that a motivation programme can be effective at improving attendance at clinic appointments but that it is not effective at improving adherence with either short-term or long-term exercise.

Summary of evidence

Overall, there is moderate evidence from one high quality study that a CB intervention is effective at improving attendance at clinic appointments. There is conflicting evidence from two low quality studies that supporting material increases short-term adherence with exercise. There is conflicting evidence from three high quality studies that CB interventions are effective at increasing short-term adherence with exercise. There is strong evidence from three high quality studies that CB interventions are not effective at enhancing long-term adherence with exercise.

DISCUSSION

This systematic review summarised the results from two low quality and three high quality studies investigating interventions to improve adherence with musculoskeletal treatment. There was moderate evidence from one high quality study that a motivation programme can be effective at improving attendance at clinic sessions. There was strong evidence that interventions are not effective at improving long-term adherence with home exercise programmes. There was conflicting evidence that interventions were effective for increasing short-term adherence.

One similar review has been identified which investigated the effectiveness of CB adherence strategies to modify physical activity behaviours in general populations (Holtzman et al., 2004). They identified 47 studies reporting on 72 different interventions and found that no specific interventions were more effective than any other. They did however find evidence that small increases in physical activity were achievable and partly maintained for at least three months after the intervention stopped. Increases in physical activity were not maintained beyond three months. This is

consistent with our review, indicating that long-term increases in physical activity may be difficult to achieve.

Several reviews in varying clinical populations had difficulty in establishing the effectiveness of any strategy to improve adherence with medical treatment (Beswick et al., 2005; Wens et al., 2008; Williams et al., 2008). However these reviews identified that psychological interventions, educational interventions, self-management strategies, spouse or family involvement and formal patient commitment using signed agreements were promising interventions worth further investigation. Other reviews concluded that no single strategy showed any clear advantage compared with another and that comprehensive interventions combining cognitive, behavioural, and affective components were more effective at improving adherence than single interventions (Roter et al., 1998; Vermeire et al., 2005). Specific strategies which could be combined were more convenient care, information, reminders, self-monitoring, reinforcement, counselling, family therapy, psychological therapy, crisis intervention, telephone follow-up, supportive care, home visits, education and work site visits (Schroeder et al., 2004; Haynes et al., 2008). Many of these strategies may be worth investigating in musculoskeletal populations.

There were indications that some, but not all, interventions which led to improvements in adherence also led to modest improvement in treatment outcome (Roter et al., 1998; Haynes et al., 2008). Furthermore, patients with chronic conditions seemed to particularly benefit from these interventions (Roter et al., 1998). None of the studies in this review investigated the relationship between adherence and treatment outcome. Research investigating this relationship is required since many patients are managing chronic musculoskeletal conditions which require long-term adherence to self-management approaches.

Strengths and limitations of this review

Although this review has been conducted in accordance with guidelines developed by the Cochrane Collaboration Back Review group (van Tulder et al., 2003), a number of factors may limit the findings. It is possible that unpublished studies, studies from non indexed journals and relevant studies from lesser known databases may have been missed. The possibility of publication bias cannot be excluded. Studies in languages

other than English were not considered. Preliminary searching revealed seven studies published in German, Italian and Danish; none of these met the inclusion criteria for this review and thus the effect of language bias is considered negligible. Finally, only five relevant studies were identified in this review thereby limiting the conclusions that could be drawn. This highlights the requirement for further investigation of strategies which optimise adherence.

Strengths and limitations of reviewed studies

All studies measured adherence to home exercise using patient-completed exercise diaries (Friedrich et al., 1998, 2005; Schneiders et al., 1998; Basler et al., 2007) or structured questionnaires (Lysack et al., 2005; Gohner and Schlicht, 2006). Poor real time compliance with diary completion and recall accuracy of patients may lead to data of questionable validity (Stone et al., 2003) and thus reduce confidence in the findings of the studies included in our review.

In two out of three studies, the CB interventions were delivered by physical therapists who had received limited (Basler et al., 2007) or unspecified (Friedrich et al., 1998; 2005) amounts of training. In neither study were therapists checked for their ability to deliver the CB intervention. Intensity and adequacy of training may be important factors for ensuring the effectiveness of the approach (Klaber Moffett et al., 2005); therefore there is some doubt about the effectiveness of the CB adherence strategies adopted in these studies.

Implications for practice

The limited evidence available does not show that simple interventions using supporting material or more complex interventions addressing attitudes, beliefs and behaviours towards physical activity are effective for improving short or long-term adherence with exercise. The evidence does provide moderate support for the use of more complex interventions addressing attitudes, beliefs and behaviours towards physical activity to improve attendance at clinic sessions.

The factors which contribute to non-adherence are multi-dimensional (Kolt et al., 2007). For example patient-related factors such as low pre-existing levels of physical activity, low in-treatment adherence with exercise, low self-efficacy, depression, anxiety,

helplessness, poor social support/ activity, greater perceived number of barriers to exercise and increased pain levels during exercise are strong predictors of poor treatment adherence in patients with musculoskeletal disorders (Jack et al., in press). Other factors related to healthcare providers and organisations are also thought to influence patient adherence (Miller et al., 1997). Consequently clinicians should retain an open mind to the range of possible cognitive, behavioural, demographic, organisational and practical barriers which may impact on patient adherence with treatment. A creative approach to dealing with the needs of individual patients may be needed, requiring that the therapist be aware of a broad range of possible strategies which may help to optimise adherence. For example the use of CB techniques alongside addressing more practical barriers (Schroeder et al., 2004; Vermeire et al., 2005; Haynes et al., 2008) may be helpful, though their value in musculoskeletal populations requires further investigation.

Implications for research

More high quality research is needed to identify strategies which promote short and long-term adherence to treatment recommendations. In addition to CB interventions, these future studies could also investigate simple measures with high clinical utility focusing upon the content of rehabilitation programmes, e.g. the type and levels of exercise, rather than just re-enforcement of programmes which may not be sufficiently targeted to meet individual needs or expectations. These studies should be adequately powered, incorporate valid and reliable measures of adherence and include cost-effectiveness analysis to assess the additional benefit on treatment outcome of any improved adherence. Further high quality research is also required to investigate the predictive validity of patient, physiotherapist and organisational barriers to adherence within musculoskeletal settings. This could also contribute to the development of better targeted adherence strategies

CONCLUSIONS

This review identified five studies investigating strategies for enhancing adherence with musculoskeletal physiotherapy treatment. There was moderate evidence that a motivational CB programme is effective at improving attendance at exercise-based clinic sessions. There was conflicting evidence that adherence strategies increase short-

term adherence with exercise. There was strong evidence that adherence strategies are not effective at improving long-term adherence with exercise. Due to the multi-factorial nature of non-adherence, single strategies may not be effective at increasing adherence. Therapists should be aware of a wide range of strategies which may help to optimise patient adherence. Interventions, which combine CB approaches with the management of practical patient barriers, may be effective at promoting adherence although further research is required to confirm this. Finally, research investigating patient, physiotherapist and organisational factors which act as a barrier to adherence could facilitate the development of better targeted strategies to overcome non-adherence.

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Table 1 The quality assessment tool of randomized clinical trials (van Tulder et al., 2003)

A	Was a method of randomization performed?	Yes/No/Don't know
B	Was the treatment allocation concealed?	Yes/No/Don't know
C	Were the groups similar at baseline regarding the most important prognostic indicators?	Yes/No/Don't know
D	Was the patient blinded to the intervention?	Yes/No/Don't know
E	Was the care provider blinded to the intervention?	Yes/No/Don't know
F	Was the outcome assessor blinded to the intervention?	Yes/No/Don't know
G	Were co-interventions avoided or similar	Yes/No/Don't know
H	Was the compliance acceptable in all group?	Yes/No/Don't know
I	Was the drop-out described and acceptable?	Yes/No/Don't know
J	Was the timing of the outcome assessment in all groups similar?	Yes/No/Don't know
K	Did the analysis include an intention-to-treat analysis?	Yes/No/Don't know

Table 2 Levels of evidence table (van Tulder et al., 2003)

Strong	Consistent findings in multiple (two or more) high quality RCTs
Moderate	Consistent findings from multiple low quality RCTs and/or CCTs and/or 1 high quality RCT
Limited	Findings from 1 low quality RCT or CCT
Conflicting	Inconsistent findings among multiple trials
No evidence from trials	No RCTs or CCTs

Note: RCT=randomised controlled trial, CCT=clinical controlled trial

Figure 1 Flow chart showing selection of studies

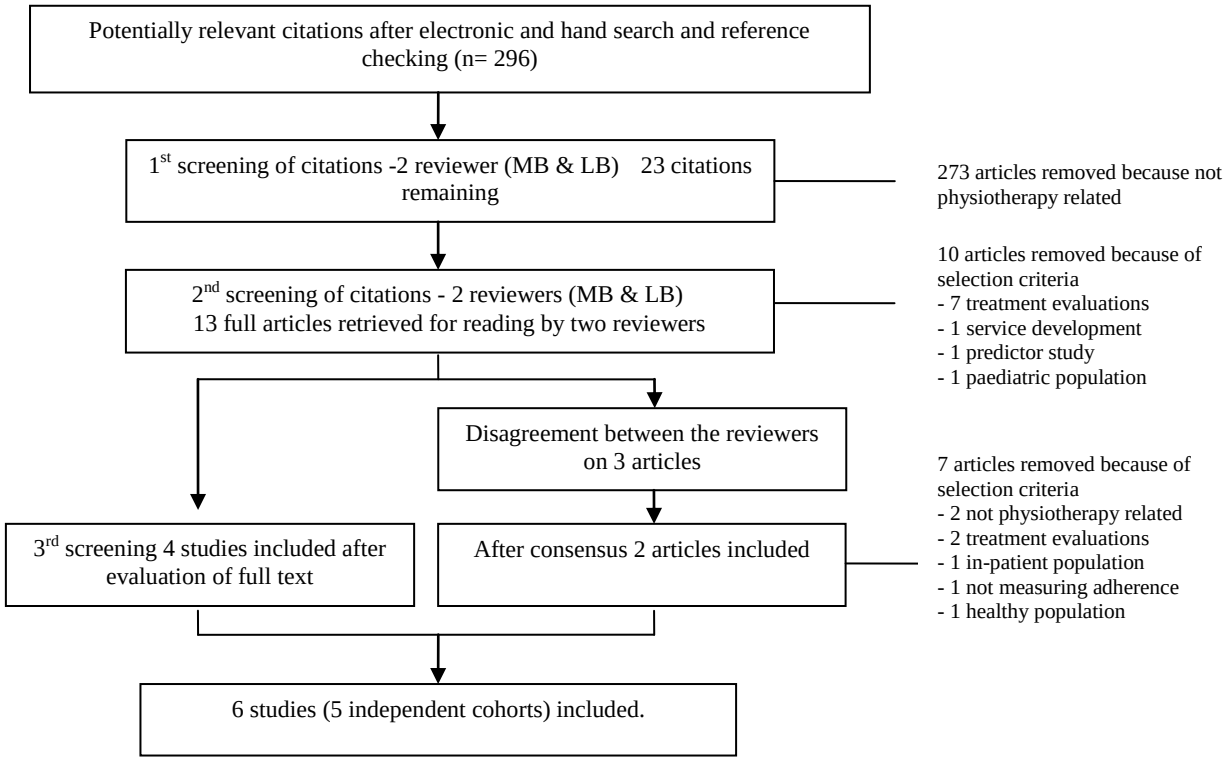

Table 3 Results of methodological assessment

	A	B	C	D	E	F	G	H	I	J	K	Quality score
Lysack et al. (2005)	0	0	0	0	0	0	1	1	0	1	0	3
Schneiders et al. (1998)	0	0	0	0	0	0	1	0	1	1	0	3
Basler et al. (2007)	1	1	1	0	0	1	0	0	1	1	1	7
Gohner & Schlicht (2006)	1	0	1	0	1	1	1	0	1	1	0	7
Friedrich et al. (1998, 2005)	0	0	1	1	0	1	0	1	1	1	1	7

Table 4 Study characteristics and results of studies

Study		
Lysack et al. (2005)	Population	40 predominantly African-American patients recruited from an orthopaedic unit in Detroit, USA, following THR & TKR surgery.
	Interventions	**Adherence intervention** - one physiotherapy session where patients were provided with a customised video with a set of therapeutic exercise. During this session the physiotherapist reviewed the exercise with the patient to ensure that the exercises were clearly understood and correctly performed. Routine in-patient care as described below was also provided **Control intervention** - routine in-patient care. This consisted of 1 x 30 minute physiotherapy session, 1 x 30 minute occupational therapy session and 2 x 1 hour group exercise classes on a daily basis. Verbal and written instructions were provided by the physiotherapist.
	Procedure	During an in-patient stay in a hospital, patients in both groups were provided with routine in-patient care and advised to continue with their exercise programme at home. The Adherence group were additionally provided with video tape support. Data on patient compliance and patient satisfaction were collected prior to discharge and at 4 week follow-up.
	Outcome Measure	Structured questionnaire to assess regularity with which patients conducted their exercises at home
	Results	All participants irrespective of group reported doing exercises regularly (usually around 2 x per day for 15-30 minutes each time. No significant between group differences were found.
Schneider et al. (1998)	Population	96 patients with acute or sub-acute, non-specific low back were recruited from 9 private practice clinics in Western Australia.
	Interventions	**Adherence intervention-** Prescribed home exercise plus a personalised computer generated print-out of each exercise. **Control intervention -** Prescribed home based exercises. 4 exercises were prescribed and instructed by the treating physiotherapist. Number of consultations, frequency of exercising and dose of exercise was determined by the physiotherapist in line with normal practice. (note: it is not clear whether the exercise were 4 standard exercises or selected from a bank of exercise at the discretion of the physiotherapist). Subjects received verbal instruction and guidance, but no written documentation
	Procedure	Patients were randomised to one of the treatment groups and provided. Data regarding prescribed exercise

		compliance was collected over a 2 week period.
	Outcome Measures	Mean percentage compliance to home exercise recorded in an exercise diary
	Results	Mean percentage compliance was significantly better ($p<0.001$) in the adherence group (77.4%) compared with the control group (38.1%).
Basler et al. (2007)	Population	170 elderly patients with chronic low back pain recruited from the departments of orthopaedics and neurosurgery of the university hospital in Marburg, Germany.
	Interventions	**Adherence intervention** - the exercise regime as described below plus 10 minutes of counselling prior to each of the exercise sessions. The counselling programme addressed readiness to change, information about chronic back pain, benefits of physical activity, self efficacy, decisional balance, commitment to exercise, self re-enforcement, re-enforcement of desired behaviour, use of social support, dealing with relapses. **Control intervention** - individually tailored flexibility, stretching, strengthening and co-ordination exercises undertaken during 10 sessions of physiotherapy administered over a 5 week period, each session lasting 20 minutes. In addition patients were given 10minutes of placebo ultrasound to control for the counselling attention received in the adherence group.
	Procedure	Patients were randomised to one of the intervention which was delivered over a 5 week period. Data on exercise adherence, functional capacity and range of motion were measured post treatment and at 6 month follow-up.
	Outcome Measures	Daily average duration of physical activity measured using a patient completed 7-day activity diary. The target behaviour was 30 minutes of self-directed physical activity each day.
	Results	Compared with baseline assessment both groups significantly increased their average duration of physical activity post treatment and at 6 month follow up ($p<0.01$). However there was no significant between group differences.
Gohner & Schlicht (2006)	Population	47 patients with non-specific, sub-acute low back pain were recruited from private physiotherapy practices in two South German cities.
	Interventions	**Adherence intervention** - In addition to the partially standardised physiotherapy, patients also attended a cognitive-behavioural training programme. 3 x 50 minute sessions took place between the first and last physiotherapy session. The aim of the training programme was to enhance self-efficacy, reduce barrier perceptions and maximise severity perceptions (i.e. provide a realistic perception of the severity of their problem). **Control intervention** - partially standard physiotherapy incorporating 10 compulsory strengthening, stretching, relaxation exercises and 12 optional exercises were chosen. Patients attended 6 sessions. Patients were requested to also undertake a selection of these exercises over and above the treatment sessions (at least 5 days per week)

	Procedure	Patients were randomised into one of the treatment groups and advised to continue the exercise programme that had been delivered during treatment. Data on self-efficacy, barriers, severity of back problem, intention to exercise, exercise behaviour were measured post treatment, at 3month and 9 month follow-up.
	Outcome Measures	Self reports of exercise behaviour using a standardised questionnaire.
	Results	Exercise behaviour increased significantly in both groups post treatment and remained improved at all time points in the CBT group. There was a significant difference between the groups at 3 month follow-up (p=0.009) favouring the CBT group, but this was not apparent either post-treatment or at 9 months follow-up.
Friedrich et al. (1998, 2005)	Population	93 patients with chronic low back pain were recruited from an orthopaedic physiotherapy outpatient clinic of Orthopaedic Hospital Speising, Vienna, Austria.
	Interventions	**Adherence intervention (M&E group)** - in addition to the control exercise programme and advice, patients in this group attended a motivation programme consisting of 5 interventions; 1) extensive counselling to emphasis the importance of regular exercise, addressing barriers and re-iterating necessity for patient involvement, 2) positive re-inforcement techniques, 3) individually negotiated oral and written contracts agreeing to the exercise schedule and reward and punishment strategies, 4) patients posting the agreement in prominent place at home and 5)maintaining an exercise diary. **Control intervention (E group)** - an individual, submaximal, graded exercise programme according to the ability of each patient. Each patient received 10 training sessions of 25 minutes, with an average training frequency of 2.3 sessions per week. Treatment consisted of mobilising, stretching, strengthening, endurance and coordination exercises. Patients were encouraged to continue the exercises at home and to remain physically active, moreover they were given postural advice and advised that adequate trunk strength and a high level of general physical fitness are effective in reducing current pain and preventing recurrence.
	Procedure	Patients were randomised to one of the interventions and attended 10 exercise training programmes. They were encouraged to continue exercising and physical activity during and after the completion of treatment programme. Data on adherence, disability, pain and physical impairments was collected at 4 month, 1 year and 5 years.
	Outcome Measures	1. Number of treatment sessions attended. 2. Training frequency and duration at 4 month, 1 year and 5 year follow-up using a daily exercise diary.
	Results	1. Patients in the M&E group were significantly more consistent in attending their treatment sessions (average mean attendance M&E= 9.6 sessions; E=8.6 sessions, p=0.0005). 81.8% of patients in the M&E group attended all 10 sessions compared with 51% of the control group.

		2. Both intervention groups appeared to maintain a reasonable level of adherence to the exercise programme, although it is not clear to what extent this has been enhanced compared with baseline activity. However there were no consistent difference in short term (4 month) or long term (1 and 5 years) adherence with exercise between the two groups.

Note: THR=total hip replacement, TKR= total knee replacement