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# Use of a goal setting intervention to increase adherence to low back pain rehabilitation: a randomized controlled trial

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## Abstract

**Objective:** To examine the effects of a goal setting intervention on self-efficacy, treatment efficacy, adherence and treatment outcome in patients undergoing low back pain rehabilitation.

**Design:** A mixed-model 2 (time) × 3 (group) randomized controlled trial.

**Setting:** A residential rehabilitation centre for military personnel.

**Subjects:** UK military personnel volunteers ($N$ = 48); mean age was 32.9 (SD 7.9) with a diagnosis of non-specific low back pain.

**Interventions:** Subjects were randomly assigned to either a goal setting experimental group (Exp, $n$ =16), therapist-led exercise therapy group (C1, $n$ = 16) or non-therapist-led exercise therapy group (C2, $n$ = 16). Treatment duration for all groups was three weeks.

**Main measures:** Self-efficacy, treatment efficacy and treatment outcome were recorded before and after the treatment period. Adherence was rated during regularly scheduled treatment sessions using the Sports Injury Rehabilitation Adherence Scale (SIRAS). The Biering-Sørensen test was used as the primary measure of treatment outcome.

**Results:** ANCOVA results showed that adherence scores were significantly higher in the experimental group (13.70 ± 1.58) compared with C2 (11.74 ± 1.35), ($P < 0.025$). There was no significant difference for adherence between the experimental group and C1 ($P = 0.13$). Self-efficacy was significantly higher in the experimental group compared to both C1 and C2 ($P < 0.05$), whereas no significant difference was found for treatment efficacy. Treatment outcome did not differ significantly between the experimental and two control groups.

**Conclusions:** The findings provide partial support for the use of goal setting to enhance adherence in clinical rehabilitation.


**Keywords:** Exercise therapy, performance profiling, self-efficacy, treatment efficacy

# Introduction

Rehabilitation goal setting is the formal process wherein a rehabilitation professional negotiates goals with the patient.[1] It has been described as a key element of the rehabilitation process, however, evidence supporting the clinical efficacy of goal setting in rehabilitation is not robust.[1–4]

Levack et al.[1] performed a systematic review examining the effectiveness of goal setting in rehabilitation settings. They concluded that while there is some evidence that setting goals can improve patient compliance to rehabilitation programmes, the evidence to support its impact on health-related outcomes was inconsistent. Lack of support for goal setting was also reported by Bassett and Petrie,[5] with no significant difference in treatment compliance between goal setting and control groups. Nonetheless, this study showed that collaboratively set goals involving the patient and therapist lead to higher compliance levels than therapist-mandated goals.

Development of the evidence base supporting goal setting in rehabilitation is hindered because goal setting practice is largely a theoretical in nature.[2,3] The theoretical understanding of goal setting in rehabilitation has been informed by psychological research, particularly from industrial and organizational psychology, summarized in 2002 by Locke and Latham.[6] In a recent review of psychological theory applied to rehabilitation goal setting, Scobbie et al.[3] proposed that Social Cognitive Theory,[7] Goal Setting Theory[6] and the Health Action Process Approach[8] offer the most potential to inform clinical practice based on their clinical utility and empirical support. It is suggested that integrating theories across common constructs might promote the development of practical frameworks to guide goal setting interventions.[2,3] Overlapping constructs within these three theories include self-efficacy, outcome expectations, goal attributes, action planning, and goal-related appraisal and feedback.[6–8]

Over the past decade, the role of psychological factors in the rehabilitation of injured athletes has been examined by several authors.[9–11] Of these factors, goal setting has been suggested to enhance patient motivation and treatment adherence by promoting higher levels of self-efficacy and treatment efficacy.[9,12,13] Likewise, a number of studies have reported that a strong belief in treatment efficacy is related to patient adherence to injury rehabilitation programmes.[9,12,13] There is also evidence indicating that belief in the efficacy of treatment is a powerful predictor of adherence.[12,14] Hence, the identification of techniques that enhance a patient's belief in the efficacy of treatment may provide a basis upon which to design interventions that increase adherence and enhance the rehabilitation process.[15,16]

Personal Construct Theory[17] has received little attention in the rehabilitation goal setting literature,[18,19] but does bear some commonalities with other theories. Central to personal construct theory is the notion that individuals continuously attempt to make sense of the world around them.[17] The implication of personal construct theory for rehabilitation practitioners is the requirement to enter the patients' 'world view', and gain their perspective upon treatment provision before meaningful goals can be set.[18] Performance profiling is a popular technique used to aid athletes in identifying priorities for training.[20] Guided by personal construct theory, performance profiling takes the perspective of the athlete to be fundamental in agreeing the goals and content of an agreed training plan, and establishing those activities that might be motivating for that individual.[20,21] Despite the popularity of the technique in a sports performance setting, there is little research examining the use of performance profiling in a clinical rehabilitation context. Therefore, its potential utility to enhance patient adherence to exercise rehabilitation programmes warrants further investigation.

Good agreement exists on the importance of exercise therapy in the treatment of subacute and chronic low back pain.[22–25] For long-term treatment effects, back pain sufferers need to adhere to treatment recommendations beyond the prescribed exercise intervention.[24] At present, treatment outcomes are compromised by adherence rates as low as 30%,[25] and there is little research demonstrating the clinical effectiveness of interventions designed to increase adherence.[22]

Using the performance profile technique as a basis for goal setting, the purpose of this study was to examine the effects of a goal setting intervention on self-efficacy, treatment efficacy, adherence and treatment outcome in patients undergoing a lower back pain rehabilitation programme. Based on previous research indicating that goal setting can enhance adherence to injury rehabilitation,[9] we hypothesized that a goal setting intervention would enhance adherence, perception of self-efficacy and treatment outcome.

## Method

The study employed a mixed-model 2 (time) × 3 (group) randomized controlled trial. Subjects comprised consecutive patient admissions into the early spines treatment group at the UK Defence Medical Rehabilitation Centre (DMRC), Headley Court. Admission for treatment involved a standardized three-week (5 days per week, 15-day intervention) residential programme of rehabilitation. Subjects were volunteers assigned to either an experimental group (Exp: goal setting and exercise therapy), control group 1 (C1: therapist-led exercise therapy) or control group 2 (C2: non-therapist-led exercise therapy). The protocol was approved by both the Ministry of Defence (MOD) Institute of Naval Medicine, and the School of Sport and Education at Brunel University ethics committees. Subjects provided informed consent in accordance with the Declaration of Helsinki.[26]

Upon admission to DMRC, subjects were randomly assigned to experimental (Exp), C1 or C2 groups. Block randomization by group was determined by a physician who was otherwise unconnected to the study. The exercise rehabilitation programme was identical for all groups, and three specialist exercise therapists with a mean of six years' experience supervised treatment sessions. The therapists were randomly allocated to each of the trial groups. Two independent therapists, who were blind to the subjects' group assignment, rated the participants using the Sport Injury Rehabilitation Adherence Scale (SIRAS) measures.

To avoid possible contamination, subjects were advised that the purpose of the study was to examine the effects of injury on patients' responses to residential rehabilitation. Subjects were unaware of the experimental and control conditions employed in the study. On day 1 and day 15 of rehabilitation, subjects were assessed for self-/treatment efficacy using the Sports Injury Rehabilitation Beliefs Survey (SIRBS), and treatment outcome (Biering-Sørensen test). The Behavioural Regulation in Exercise Questionnaire (BREQ-2) was used as a covariate in the analyses. BREQ-2 was administered on day 1, and SIRAS scores (three per week) were taken for each subject at regularly scheduled treatment sessions. In accordance with previous recommendations,[27] a mean value was calculated for the SIRAS across the nine appointments, to yield an overall adherence score.

The exercise programme consisted of individual and group-based submaximal, incremental exercise. Treatment was directed towards improving spinal mobility, trunk/lower-limb core stability, muscle stretching, movement coordination and low-intensity cardiovascular conditioning. Each subject undertook a total of ten 30-minute exercise sessions each day. This intensive regimen included hydrotherapy, active recovery sessions, relaxation periods and regular breaks throughout the treatment day. The exercises performed in each session varied in accordance with the physical ability of each subject. Exercises were adapted and progressed according to the results of regular assessments throughout the treatment period.

Experimental group subjects completed the standard exercise programme and a goal setting performance profile assessment. At an initial meeting with each subject in the experimental group, the first author introduced performance profiling as a technique that would aid the rehabilitation process. Constructs that each subject considered as fundamental priorities for successful rehabilitation were generated (see anonymized example in Appendix A online). The subject was asked 'What are your priorities and goals for the three-week rehabilitation programme?' Subjects were assisted by the author to generate several priority goals. They were asked to rate the perceived importance of each goal on a 10-point scale. Subjects were then required to rate their current 'state' against an ideal of 10 for each goal. Using these scores a calculation was then completed to establish each subject's treatment priorities. This personal goal profile formed a basis for goal setting and the subject's exercise rehabilitation. Follow-up meetings were held on days 6 and 11, and included a repeat administration of the performance profile, addition of any new goals, and a repeat of the proximal goal setting process based on progress up to that point. Each subsequent meeting formed a basis for the next set of goals. The goal setting protocol used has received greater coverage elsewhere,[19–21] was based on guidelines from the adherence and goal setting literature,[9] and was consistent with the propositions underlying personal construct theory and performance profiling.[17,20] Example goals included achieving a set range of motion in the spine, completing a specified number of exercises in each session, and better pain management during walking and running activity (see Appendix A online).

C1 subjects completed the standard exercise programme. There was a strong emphasis on therapist-directed exercise completion, and the supervising therapist provided verbal encouragement and support, as well as individual coaching on correct exercise technique. C2 subjects also completed the standard exercise programme. The C2 supervising therapist did not provide verbal encouragement to motivate subjects, but did monitor exercise technique to ensure their safety. The inclusion of this group attempted to control for the promotion of adherence through the receipt of social support.[28]

Adherence to rehabilitation was measured using the Sport Injury Rehabilitation Adherence Scale (SIRAS).[15] This is a three-item scale that measures the practitioner's ratings on (a) the degree to which patients exert themselves, (b) the degree to which patients follow the practitioner's instructions and (c) the degree to which patients are receptive to changes in the rehabilitation programme. The SIRAS employs a 5-point Likert-type scale for each of the three items. Scores for the three items are summed to create a composite score out of 15, and a mean of the composite score across nine administrations was used for analysis. Higher scores reflect higher levels of adherence. Research has demonstrated high internal consistency ($\alpha = 0.82$), test–retest reliability (ICC = 0.77 over a one-week period), inter-rater reliability, factorial validity and construct validity of the SIRAS.[15,27]

The Sports Injury Rehabilitation Beliefs Survey (SIRBS)[12] was used to assess both self-efficacy and treatment efficacy. The SIRBS is a 19-item instrument that contains five subscales. In the present study, only the treatment efficacy (four items), and self-efficacy (four items) subscales were used. Acceptable alpha coefficients have been reported for treatment efficacy (0.85) and self-efficacy (0.91).[29] Low-to-moderate interscale correlations for the SIRBS subscales provide some support for its divergent validity.[9]

Treatment outcome was measured using the modified Biering-Sørensen test30 (see Appendix B online). The Biering-Sørensen test has been shown to be reliable as a measure of back extensor endurance, and has been accepted as a valid outcome measure in the rehabilitation of lower back pain.[31,32]

Behavioural regulations are a personal factor consistently linked with adherence,[33] and was assessed using the Behavioural Regulation in Exercise Questionnaire (BREQ-2).[34] In the present study, the BREQ-2 was used as a covariate to account for the possible confound of motives for exercise participation on adherence. Recent research has supported the multidimensional four-factor structure of the BREQ-2, and its ability to discriminate between physically active and non-active groups.[28] A Relative Autonomy Index[35] was computed to represent overall self-determination, such that a more positive score denoted greater self-determination.

Data were analysed using SPSS version 11.0 for Windows (SPSS Inc, Chicago, IL, USA). A power analysis was conducted to establish appropriate sample-size requirement using the estimate procedure suggested by Cohen.[36] Power $\beta$ was set at 0.80, and type 1 error $\alpha$ of 0.05. A total of 16 participants were recruited into each of the three groups (total sample: $N = 48$). Descriptive statistics were calculated for all measured variables. Between- and within-group differences for the dependent variables treatment outcome, and self-/treatment efficacy were analysed using a mixed-model 2 (time) × 3 (group) multivariate analysis of covariance (MANCOVA). A one-way repeated measures ANCOVA was used to analyse adherence data. Preliminary assumption testing was conducted to check for normality, linearity, homogeneity of variance–covariance matrices and multi-collinearity.[29]

## Results

The sample comprised 48 subjects (45 men and 3 women), with a clinical diagnosis of chronic low back pain (mean duration of symptoms 2.6 years, SD 0.3), referred to DMRC for inpatient rehabilitation. The subjects' age range was 18–48 years (mean 32.9 years, SD 7.9), and they all engaged in low-intensity exercise prior to admission (mean hours per week 3.2, SD 0.6).

The flow of subjects through the study is illustrated in Figure 1. No significant age difference was found among experimental and control groups $F(2,44) = 0.61$ ($P = 0.55$), and the proportion of males and females was similar for treatment and control conditions. Data screening revealed that there were no univariate or multivariate outliers. Tests of the within-cell distribution properties of the data revealed minor violations of normality in 3 of the 48 cells ($P < 0.05$, see Table 1). The post-treatment score for self-efficacy in the experimental group exhibited negative skewness; while the adherence(SIRAS) score for the experimental group exhibited negative skewness and positive kurtosis. An evaluation of the assumptions of normality, homogeneity of variance–covariance matrices, linearity and multi-collinearity yielded largely satisfactory results. Mauchly's test of sphericity (Mauchly's $W = 1.00$), and Box's *M*-test were both non-significant ($P > 0.05$). There was no group effect for the covariate Relative Autonomy Index and thus it was not included in subsequent analysis. Collectively, the non-significant covariate effects revealed that the Relative Autonomy Index did not moderate the relationship between group allocation and the combined dependent variables: self-efficacy, treatment efficacy and Biering-Sørensen score (Table 2). Group assignment accounted for 25% of the variance on the composite dependent variables over time. Two psychological variables, self-efficacy and treatment efficacy, showed a significant time × group interaction effect associated with a large effect size ($\eta_p^2 = 0.33$ and 0.23, respectively).

The main effects indicated a significant ($P < 0.025$) difference in adherence scores between the three treatment group $F(2,44) = 6.27$, with a large effect size (ηp

2 = 0.22). Follow-up multiple comparisons with Bonferroni adjustment (Table 3) showed significantly higher adherence scores in the experimental group compared with C2, 97.5% confidence interval = –3.33 to –0.38, ($P < 0.025$). There were no significant differences for adherence scores between C1 and C2, or C1 and the experimental group ($P > 0.025$). A plot illustrating group adherence data over time is provided in Figure 2. An inspection of the mean scores after adjustment for the covariate Relative Autonomy Index (Table 4) showed higher levels for all dependent variables in the experimental group compared to C1 and C2.

Multivariate analysis revealed a statistically significant difference over time (pre–post-treatment) on the composite dependent variables regardless of group allocation $F(3,42) = 7.99$ ($P < 0.01$), which was associated with a large effect size ($\eta_p^2 = 0.36$). Wilks' criterion indicated there was a significant two-way interaction for group × time (see Table 2), $F(6,84) = 4.54$ ($P < 0.01$, $\eta_p^2 = 0.25$). There were no between-group effects for the covariate Relative Autonomy Index, $F(3,42) = 1.78$ ($P > 0.05$, $\eta_p^2 = 0.11$). Follow-up univariate analysis showed a significant group × time effect for self-efficacy, $F(2,44) = 10.66$ ($P < 0.001$, $\eta_p^2 = 0.33$) and treatment efficacy $F(2,44) = 6.72$ ($P < 0.025$, $\eta_p^2 = 0.23$). The group × time interaction for the Biering-Sørensen score was non-significant, $F(2,44) = 0.86$ ($P > 0.05$, $\eta_p^2 = 0.01$).

## Discussion

The primary aim of this study was to examine the effects of a goal setting intervention on adherence, self-efficacy, treatment efficacy and treatment outcome in patients undergoing a low back pain rehabilitation programme. The results show that adherence scores (SIRAS) were significantly higher in the experimental goal setting group when compared with C2 ($P < 0.025$). This supports the positive effects of goal setting on adherence.[9,11] It is likely that the experimental group were focused on specific, individually-tailored goals that promoted adherence, while the C2 group had a less structured environment resulting from reduced therapist input to the programme.[18] Bassett and Petrie5 also showed that patient–therapist set treatment goals resulted in higher treatment compliance to exercise than physiotherapist mandated goals.

There was no significant difference for adherence between the experimental group and C1 group ($P = 0.13$). This finding suggests that the goal setting process itself did not affect patient adherence between the experimental and C1 group. Thus it is likely that the favourable adherence scores observed between the experimental group and C2 may rather be due to several other factors resulting from the patient and therapist relationship. Friedrich et al.[23] found that patients suffering from low back pain were more motivated to adhere to exercise when a supervising therapist was present. Through encouragement and support, the therapist provides the patient with a measure of control over the rehabilitation process, thereby serving to increase commitment and adherence.[37] Given the burgeoning evidence that prolonged supervision is a key factor in rehabilitation adherence,[22,23,37] the support and supervision given to subjects' in the experimental and C1 groups may explain why subjects adherence scores were higher than was the case in the C2 group.

With regards to the effect of goal setting on measures of self-efficacy the experimental group exhibited significantly higher scores ($P < 0.05$) when compared to both control groups. This is consistent with previous findings indicating a relationship between increased self-efficacy, and adherence.[16,38–40] Levy et al.[38,40] found that belief in the efficacy of treatment significantly predicted clinical rehabilitation adherence, and that task support from the clinician and being self-efficacious were perceived to aid adherence in recreational athletes. In addition, Mannion et al.[39] found a significant correlation with multidimensional adherence and self-efficacy in 37 patients suffering from low back pain. Bandura[41] suggested that perceived self-efficacy determines the amount of effort invested and persistence in the face of obstacles. It is possible the current performance profiling goal setting intervention may have resulted in the therapist 'yielding' control of treatment to the patient,[38] thereby promoting self-efficacy and a series of performance accomplishments.[9]

When comparing scores for treatment efficacy across the groups, no significant difference was found between the experimental goal setting group and either C1 or C2. The highest mean values for treatment efficacy ($M = 22.13$, SD = 2.66) were seen in the experimental group. Thus, it is possible the sample size used in the present study was insufficient to yield a significant effect for treatment efficacy. In addition, it is worth noting that the C2 group showed a 6% decrease in treatment efficacy score over the trial period. This could be attributed to C2 subjects not receiving verbal encouragement in the present study. Past authors have suggested that treatment efficacy is enhanced when (a) subjects identify potential barriers related to low treatment efficacy and (b) the therapist provides encouragement and verbal persuasion regarding the potential benefits of treatment.[9,12,16] Thus, this observed reduction in treatment efficacy indicates the importance of the health professional reiterating the benefits of the treatment to patients in order to enhance treatment efficacy and adherence. Spetch and Kolt[37] ascertain that practitioners should ensure that rehabilitation programmes are personalized to suit an individual's unique characteristics and circumstances to promote favourable beliefs regarding treatment. Consequently, the belief by the subject that treatment will achieve its desired goals appears crucial to treatment adherence.[33,42]

No significant ($P > 0.05$) between-group changes were observed in Biering-Sørensen test scores over time, indicating that all treatments were equally effective in this regard. Thus, contrary to the research hypothesis, no positive effects of goal setting on treatment outcome were observed. This finding does not concur with the findings by Mannion et al.[39] who reported that positive changes in patient adherence and self-efficacy scores were significantly related to pain reduction and rated disability in lower back pain sufferers. In the present study, while the mean Biering-Sørensen test scores were higher in the experimental group compared to both C1 and C2, it is possible our sample size was not sufficiently large to detect significant between group differences for treatment outcome.[43] Despite the goal setting intervention having a positive effect on self-/treatment efficacy and adherence, there was no complete chain of cause and effect between enhanced self-/treatment efficacy, greater adherence and superior treatment outcome as measured by the Biering-Sørensen test.

In a recent review of rehabilitation goal setting, Levack et al.[1] found seven high-quality trials reporting no significant effects of goal setting on rehabilitation outcome. Contrary to these findings, Pizarri et al.[11] reported a significant relationship between home-based exercise adherence and several treatment outcomes in 68 subjects following reconstructive surgery of the anterior cruciate ligament. Nonetheless, this prospective cohort study showed a negative adherence–outcome relationship for subjects over 30 years of age. In our study, the mean age of subjects was 32.9 years. Accordingly the present findings support previous research showing that age is a moderating factor in the adherence–outcome relationship.[11]

Study subjects were diagnosed with non-specific low back pain and diverse clinical conditions would have been responsible for this diagnosis. Healing rate has been used as an index of adherence and rehabilitation outcome in several studies.[11,22–25] This assumes that those who recover faster from the injuries do so due to their adherence to the treatment regimen. Nonetheless, Brewer[33] suggested that this assumption is not warranted and inevitably results in the confounding of adherence with treatment outcome. The Biering-Sørensen test is an indirect measure of healing rate reflected by spinal extensor endurance scores. It is possible that subjects with more severe pathologies had different healing rates when compared with their less severe counterparts. Future studies could overcome this limitation by considering injury severity as a potential moderator in the study design.

There are a number of limiting factors to consider in the current study design. The inclusion of two control groups resulted in a reduced sample size per group. Based on clinical assumptions, the results of previous studies[44] and the effect size reported in our study ($\eta_p^2 = 0.22$), an estimated sample size of $N = 270$ (90 per group) would be required for a definitive trial. This calculation assumes 80% power to detect a 25% between-group difference in subject adherence scores, and a nil drop-out rate. Furthermore, in the present study a homogeneous sample population was used, thereby limiting the generalizability of the results with respect to other injury types. Perhaps more significant is that the present authors were not able to control for injury severity, and so the non-exercise treatment received by each subject was not standardized. For instance, some patients may have been prescribed drugs that affected pain and consequently their ability to perform exercise, while others may have received manual physiotherapy. However, it can be argued that standardization of a low back pain programme for a group exhibiting a diverse range of low back pathologies is not possible. In addition, the presence of a therapist may have led the C2 group to perceive support to be available, and the attempt to control for social support may not have been entirely successful. In addition, there was no follow-up beyond the three-week treatment and no conclusions can be drawn about the long-term benefits of the intervention. Nonetheless, the present study was successful in examining the effects of a goal setting intervention within a clinical setting. By including a measure of rehabilitation outcome the authors were able to address methodological limitations of previous injury rehabilitation research1,[33] and the protocol of administering a measure of behavioural regulation (BREQ-2) prior to randomly assigning subjects to one of three groups is a clear strength.[9,16]

Although the results of the present study partially support the use of goal setting in lower back pain rehabilitation, further research is needed to develop a clearer picture of the value of goal setting on rehabilitation adherence. Thus, additional experimental research is warranted in which personal construct theory parameters are manipulated and the subsequent effects on adherence are evaluated. Finally, given that this study was conducted under tight experimental conditions, additional research with different injury types, varying duration of rehabilitation interventions, and follow-up assessments would help determine the general applicability of the present results.

## Clinical messages

- Goal setting may have positive effects on self-efficacy, treatment efficacy and adherence levels in low back pain rehabilitation.
- Continued encouragement, supervision and explanation of treatment benefits appear to increase adherence to a rehabilitation programme.
- Greater adherence to prescribed interventions does not necessarily result in better rehabilitation outcomes.

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**Table 1**. Descriptive statistics for dependent variables pre-and post-treatment.

| Dependent variables | Pre-treatment | | | Post-treatment | | |
|---|---|---|---|---|---|---|
| Control Group 1 | *M* ± SD | Std. Skew | Std. Kurt | *M* ± SD | Std. Skew | Std. Kurt |
| RAI[a] | 12.96 ± 3.10 | –0.24 | 1.11 | – | – | – |
| Adherence[b] | – | – | – | 12.98 ± 1.78 | –0.61 | –1.48 |
| Treatment-efficacy | 19.19 ± 2.29 | –0.20 | 0.37 | 18.44 ± 2.61 | –0.26 | 1.23 |
| Self-efficacy | 22.81 ± 2.88 | –1.48 | 0.63 | 23.07 ± 3.23 | –0.23 | –0.36 |
| Biering-Sørensen Score | 46.94 ± 41.20 | 1.50 | –0.16 | 85.31 ± 46.94 | 1.11 | –0.41 |
| Control Group 2 | | | | | | |
| RAI[a] | 6.56 ± 2.63 | 1.52 | –0.12 | – | – | – |
| Adherence[b] | – | – | – | 11.74 ± 1.35 | –2.20 | 1.58 |
| Treatment-efficacy | 17.44 ± 3.25 | 0.67 | –0.44 | 16.63 ± 3.58 | –0.87 | –0.82 |
| Self-efficacy | 21.25 ± 3.71 | –0.37 | 0.33 | 22.00 ± 3.83 | –0.07 | –0.67 |
| Biering-Sørensen Score | 39.81 ± 37.92 | 1.24 | –0.94 | 77.00 ± 43.50 | –0.84 | –1.30 |

**Table 1** continued

| Dependent variables | Pre-treatment | | | Post-treatment | | |
|---|---|---|---|---|---|---|
| Intervention Group | *M* ± SD | Std. Skew | Std. Kurt | *M* ± SD | Std. Skew | Std. Kurt |
| RAI[a] | 7.72 ± 7.19 | –0.25 | –1.15 | – | – | – |
| Adherence[b] | – | – | – | 13.70 ± 1.58 | –2.95* | 3.01* |
| Treatment-efficacy | 19.25 ± 4.20 | 0. 61 | -0.65 | 22.13 ± 2.66 | 0.55 | 0.17 |
| Self-efficacy | 22.25 ± 3.15 | 1.71 | 1.21 | 25.81 ± 2.23 | 2.45* | 1.52* |
| Biering-Sørensen Score | 82.75 ± 48.50 | 1.97 | 1.38 | 124.63 ± 41.64 | 1.81 | 0.98 |

Std. Skew, standard skewness; Std. Kurt, standard kurtosis; RAI, Relative Autonomy Index.

*Cells violating normal distribution values between –1.96 and 1.96.

[a]x1 BREQ-2 (RAI) measurement administered pre-treatment only.

[b]x 9 (SIRAS) measurements collected throughout the trial period summed to yield an overall adherence score.

**Table 2**. Combined effects of dependent variables across time adjusted for BREQ-2 (RAI) covariate and treatment group allocation.

| | Value | *F* (df.) | $\eta^2$ |
|---|---|---|---|
| Pre–post treatment | 0.637 | 7.99 (3,42)** | 0.36 |
| Pre–post treatment x RAI | 0.887 | 1.78 (3,42) | 0.11 |
| Pre–post treatment x group | 0.570 | 4.54 (6,84)** | 0.25 |

All $\eta^2$'s are partial $\eta^2$'s . * $P < 0.05$, ** $P < 0.01$.

**Table 3**. Pairwise group comparisons for adherence (SIRAS) scores.

| (I) Study group | (J) Study group | Mean difference (I–J) | Sig. | 97.5% Confidence interval for difference [a] | |
|---|---|---|---|---|---|
| | | | | Lower bound | Upper bound |
| Control 1 | Control 2 | 0.683 | 0.728 | –0.911 | 2.278 |
| | Intervention | –1.174 | 0.128 | –2.727 | 0.379 |
| Control 2 | Control 1 | –.683 | 0.728 | 2.278 | 0.911 |
| | Intervention | –1.857 | 0.003 | –3.328 | –0.387 |
| Intervention | Control 1 | 1.174 | 0.128 | –.379 | 2.727 |
| | Control 2 | 1.857 | 0.003 | 0.387 | 3.328 |

Note. Based on estimated marginal means

[a]Adjustment for multiple comparisons: Bonferroni.

**Table 4**. Between-group comparison of mean scores for self-efficacy, treatment efficacy and Biering-Sørensen test.

| Measure | Study group | Pre–post | Mean | 95% Confidence interval | |
|---|---|---|---|---|---|
| | | | | Lower bound | Upper bound |
| Treatment efficacy | Control 1 | 1 | 17.25 | 15.64 | 18.87 |
| | | 2 | 18.03 | 16.45 | 19.60 |
| | Control 2 | 1 | 18.05 | 16.50 | 19.61 |
| | | 2 | 16.90 | 15.37 | 18.41 |
| | Experimental | 1 | 19.58 | 18.05 | 21.10 |
| | | 2 | 22.27 | 20.78 | 23.76 |
| Self-efficacy | Control 1 | 1 | 22.10 | 20.44 | 23.75 |
| | | 2 | 22.63 | 20.96 | 24.32 |
| | Control 2 | 1 | 21.72 | 20.12 | 23.32 |
| | | 2 | 22.30 | 20.65 | 23.90 |
| | Experimental | 1 | 20.50 | 18.93 | 22.10 |
| | | 2 | 25.97 | 24.34 | 27.56 |
| Biering-Sørensen test | Control 1 | 1 | 43.11 | 20.15 | 66.10 |
| | | 2 | 78.73 | 55.53 | 101.95 |
| | Control 2 | 1 | 42.30 | 20.14 | 64.45 |
| | | 2 | 81.28 | 58.88 | 103.69 |
| | Experimental | 1 | 84.09 | 62.40 | 105.82 |
| | | 2 | 126.92 | 104.96 | 148.89 |

a. Covariates evaluated at Relative Autonomy Index value of 9.08.

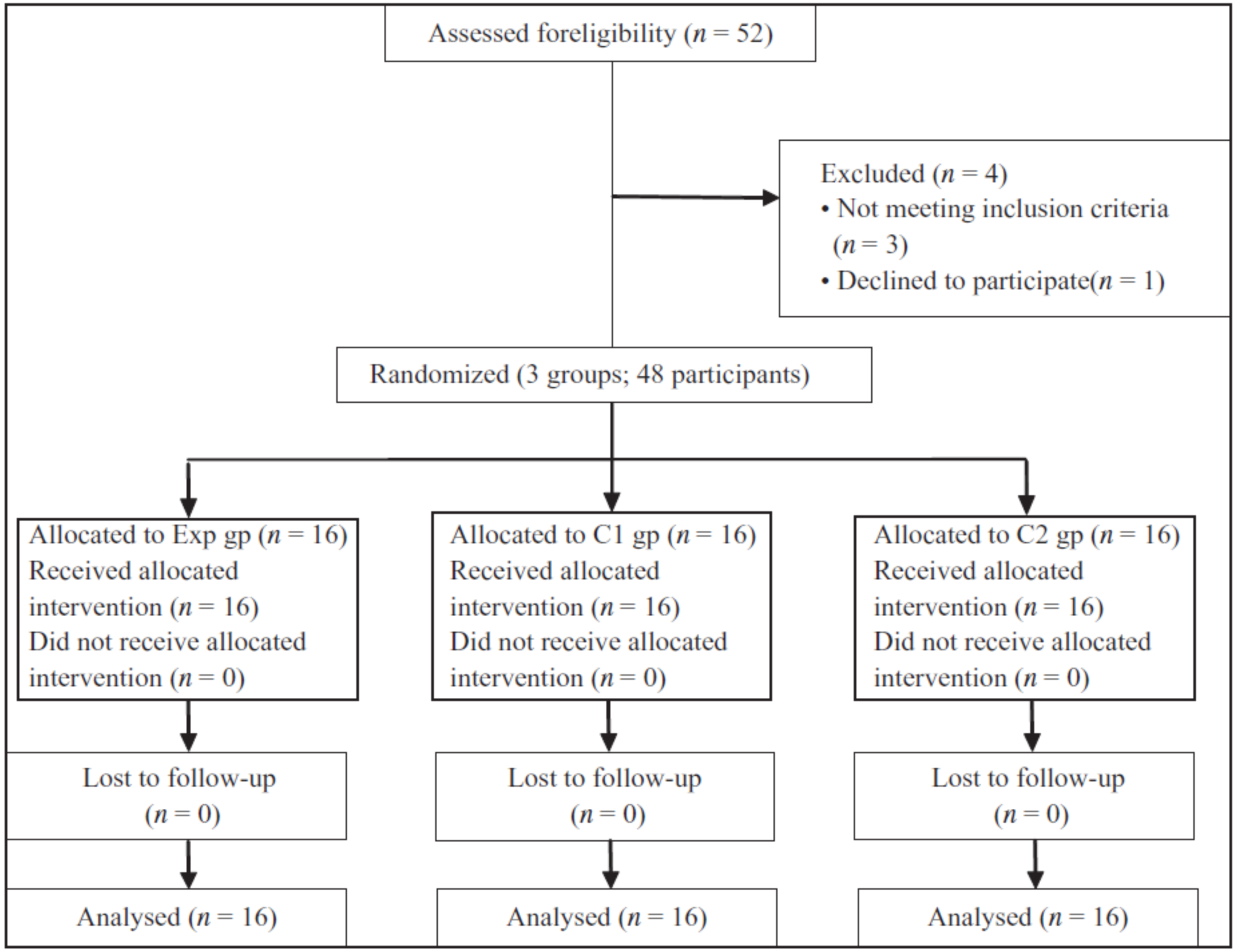



**Figure 1**. Trial profile – flow of groups and subjects through the study. Exp, goal setting experimental group; CI, therapist-led exercise therapy group; C2, non-therapist-led exercise therapy group.

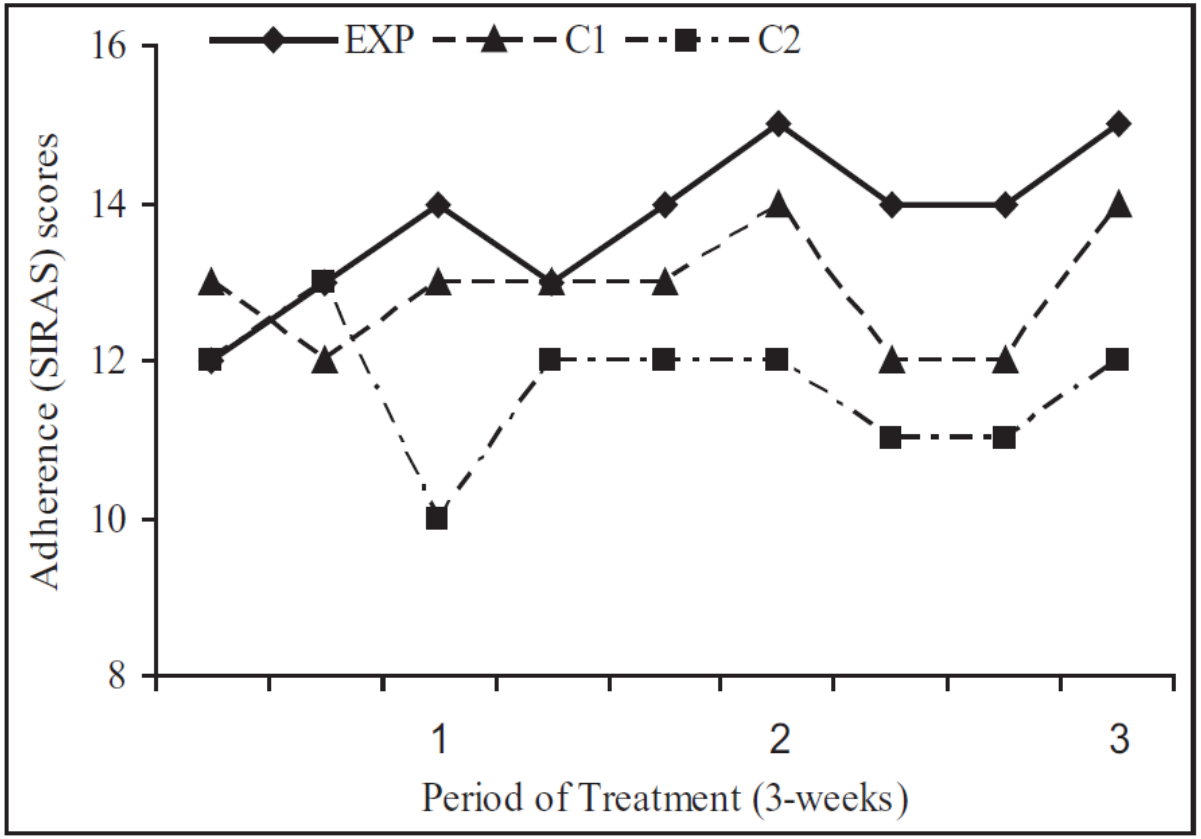



**Figure 2**. Plot of adherence scores for experimental, C1and C2 study groups over the period of treatment.

## APPENDIX A

**SPINES PROGRAMME GOAL SETTING – PATIENT PROFILE ASSESSMENT RECORD**

**Subject No:** [ ] **Name & Initials:** [ ] **Admission Date**: dd/mm/yyyy : [ _ _ / _ _ / _ _ _ _ ]

**Goal Setting Review Date:** (a): [ _ _/ _ _/ _ _ _ _ ] (b) [ _ _/ _ _/ _ _ _ _ ] (c) [ _ _/ _ _/ _ _ _ _ ]

Information from the patients 'Importance' and 'Now' questionnaires should be transferred onto this sheet. These results will form the basis of the specific performance goals agreed with the patient.

| **Characteristic Identified by the Patient**[1] | **Subjects Perceived level of Importance Rating (PIR)**[2] | **Subjects current 'self-assessment' now rating (PNR)**[3] | **Discrepancy Score (10 - PNR) x PIR**[4] | **Priority Rating**[5] | **Operationalized Goal**[6] |
|---|---|---|---|---|---|
| Improve (pain free) walking tolerance | 9 | 8 | 18 | 5 | Half-mile walk pain free by week 1. |
| Improve abdominal strength. | 9 | 6 | 36 | 2 | Perform x 3 sets of 10 repetitions in pain free range. |
| Return to running and improve CV fitness | 9 | 5 | 45 | 1 | Perform 30 minutes cycling by week 1, |
| Improve flexibility and range of | 10 | 7 | 30 | 3 | Improve Schober's flexion by 5 mm. |

| | | | | | |
|---|---|---|---|---|---|
| movement | | | | | |
| Reduce pain during exercise | 8 | 8 | 16 | 6 | Identify all pain creating movements by week 1. |
| Increase seating tolerance | 10 | 8 | 20 | 4 | Increase seating tolerance by 5-mins per day during week 1 OT sessions. |
| Return to ‘recreational’ swimming | 9 | 8 | 18 | 5 | Attend all hydrotherapy sessions in week 1. |

[1] Characteristics, variable and ‘general’ construct the subject selects as priority areas for attention during rehabilitation.

[2] The subjects perceived importance of this characteristic rated on a scale of 1 to 10.

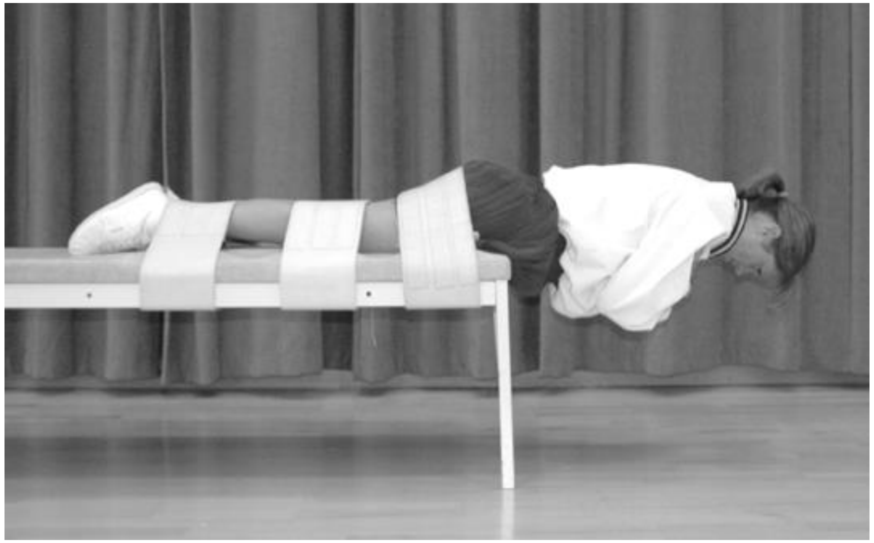
[3] The subjects current rating of their ability / performance against an ideal state of 10.

[4] The calculation to determine the ‘discrepancy’ value between the PIR and PNR. The higher discrepancy value indicates a higher priority for treatment planning.

[5] The priority rating (highest priority is 1, lowest priority is 6). Subjects exercise intervention /programme is then designed based on this priority grading.

[6] The information gained from the other elements of the profiling assessment is then operationalized as a specific performance goal.

**APPENDIX B**



Endurance testing of spinal extensors using the modified Biering-Sørensen test.