Exercise therapy compliance in acute low back pain patients

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SUMMARY. **This study obtained data on short-term compliance with therapeutic home-based exercise for patients' with acute or sub-acute spinal pain, and investigated the intervention of an educational strategy of written and illustrated reinforcement to improve compliance in Low back pain (LBP) patients. Ninety-six LBP patients were randomized into study or control groups with the study group receiving verbal and written exercise instructions and the control group verbal instruction alone.**

Patients receiving additional written and illustrated instruction had a significantly higher mean compliance (77.4%) compared to the group who received verbal instruction alone (38.1%). T-test analysis indicated a significant difference between groups for compliance to the prescribed exercises ($P < 0.000$).

It is inferred from this study that written reinforcement used as an educational strategy to improve compliance to home-based exercises is an effective and clinically viable strategy. It is recommended that exercise is prescribed with accompanying written and illustrated instructions to increase compliance in prospective clinically randomized trials on therapeutic exercise.

INTRODUCTION

Manipulative physiotherapy, with its emphasis on joint movement and exercise, has become increasingly important for the treatment of pain and dysfunction, associated with low back pain (LBP) (Twomey & Taylor 1995). Therapeutic exercise is considered to be one of the more commonly prescribed treatments for LBP by physiotherapists (Quinet & Hadler 1979; Martin et al 1986), and the efficacy of therapeutic exercise can only be established when patients comply with the exercise regimen being studied (Sluijs et al 1993). Compliance to a therapeutic regimen is defined as the extent to which a person's behaviour coincides with health advice (Sackett & Haynes 1976).

Patient compliance assumes importance in physiotherapy because it may bring about potential savings in treatment costs, avoidable morbidity, and unwanted side effects that might be achieved by maximizing compliance with safe and inexpensive active regimens such as exercise. Physiotherapists undertaking research into these regimens must also realize that the evaluation of the efficacy of these treatments depends largely on a level of compliance considered substantial enough to bring about the desired results or outcome. Adequate effort to ensure and measure compliance are necessary to gauge efficacy of an intended therapy (Deyo 1982; 1991), and to a large extent the accuracy of any estimate of compliance is dependent upon the measurement tools used.

Compliance can be viewed as both an attitude and a behaviour. Compliance as an attitude consists of a willingness or intention to follow health prescriptions, whereas behaviour relates to the actual carrying out of prescriptions. Non-compliant behaviour could then include reluctance, reactance, and recidivism characterized by disinterest, refusal to comply, or lack of sustained effort to follow health recommendations (Schlenk & Hart 1984).

The prescription of exercise, like dietary modification, demands that the patient change established habits of life-style; not simply add a medication (Mayo 1978). Changes in lifestyle are also more difficult to measure in a valid, qualitative fashion (Hulka 1979). The greater the degree to which the program depends on changing the motivations of the individuals, the harder it will be to implement the intervention and the harder it will be to effect change (Caplan & Nelson 1973). Cooperation with an exercise program is enhanced when the transactions between therapist and patient involve inquiry into

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the patients' beliefs and lifestyle and lead to problem solving focused on identifying mutual therapeutic goals (Jensen & Lorish 1994).

LBP is widely recognized as one of the most serious and escalating health disorders presently afflicting the western world, incorporating large proportions of the population and costing a great deal in lost productivity and health related expenditure. The therapeutic management of the LBP patient, that is, the establishment of a medical regimen, and the acceptance or rejection of medical advice are complex phenomena (Davis & Eicchorn 1963), and clinical research into the effectiveness of treatment of LBP is notoriously difficult and limited in scope (Berquist-Ullman & Larson 1977).

Many treatment programs for LBP prescribe a combination of exercise components, and although there is little agreement on specific regimens, there is judicious clinical consensus that exercise plays a major role in the treatment of mechanical LBP (Deyo 1991; Witt 1991; Lamb & Frost 1993; Twomey & Taylor 1995).

An exercise program is defined as a personalized regimen of recommended physical activity, specifically and systematically designed (Tancred & Tancred 1996). The prescription of therapeutic exercise is generally perceived to be the most complex and difficult part of physiotherapy (Martin 1982; Wood 1989), and the development of an exercise regimen to produce a desired and appropriate response or outcome is said to be just as specific as, and often more involved than, the prescription of a pharmaceutical compound (Kottke 1982).

Compliance to exercise programs has been studied fairly extensively in cardiac rehabilitation programs, in regular physical fitness programs, and to a lesser degree in rheumatoid arthritis treatment. Studies on compliance have assessed healthy adults, participants in primary and secondary prevention programs for cardiopulmonary disease, and patients being treated for diabetes, obesity, and depression. Surprisingly, their patterns of compliance are remarkably similar (Dishman 1986). Studies in exercise compliance to date, have dealt with percentages of compliance, as well as characteristics of compliers and non-compliers, and various interventions and their effect on compliance.

The development of methods for improving patients' compliance requires insight into factors that are related to noncompliance in physiotherapy (Sluijs et al 1993) and which are also easily amenable to change in a standard clinical environment. It would seem appropriate to first concentrate on compliance strategies that can be easily applied in physiotherapy practice, that do not require therapists to have complex additional skills, and of which major gains can be attained with minimal effort.

Little quantitative study has been performed to determine exercise compliance for patients presenting with acute LBP. This issue was addressed in a randomized, prospective survey involving patients who sought manipulative physiotherapy management. The study obtained data on short-term compliance for therapeutic home-based exercise in 96 patients with acute or subacute spinal pain, and investigated the intervention of an educational strategy of written and illustrated reinforcement to improve compliance in LBP patients.

METHOD

Study subjects and randomization

The study population consisted of 96 subjects considered by a registered physiotherapist to have a non-specific cause for their presenting complaint of LBP. Accepted into the study were subjects aged between 17 and 68 years presenting for treatment at nine private physiotherapy clinics geographically spread over the Perth metropolitan area of Western Australia. The group members of the study population were bound by the common denominator of seeking treatment from a private physiotherapy practitioner.

Random allocation to the control or study group was performed in blocks of 10 subjects. Following random allocation, the control group consisted of 49 subjects comprising 30 males and 19 females, with a mean age of 37.2 (SD 13.2) years. The experimental group consisted of 47 subjects comprising 26 males and 21 females, with mean age of 38.1 (SD 12.2) years. Exclusion criteria included; back pain of greater than 3 months duration, a previous episode of back pain in the preceding 6 months, and patients presenting with major neurological signs. Subjects included in this study were therefore recruited with classifications 1–3 of the Quebec Task Force on Spinal Disorders classification of low back pain (Spitzer et al 1987). Recruitment continued consecutively until the required number of statistically determined subjects were obtained ($n = 100$).

The consulting physiotherapist was blind to the allocation of the study population to either the control or study group. The physiotherapist maintained access to the prescribed exercise instructions by way of prescriptive exercise manuals (Versal©), and access to the dosage prescribed through the patients notes, at all times during this study for the purpose of exercise monitoring and review.

Procedure

Subjects incorporated in to the study were requested to complete an initial Oswestry Low Back Pain Disability Questionnaire (ODQ) (Fairbank et al 1980) and were each allocated an exercise diary, a Personal Information and Compliance Questionnaire combined with a Habitual Physical Activity Questionnaire (Baecke et al 1982), and a second ODQ. They were instructed to complete the diary immediately after completion of each exercise session, and to complete the questionnaires and the second ODQ at the completion of the study period. The ODQ was used to monitor pre- and post-intervention self-reported functional disability.

Habitual physical activity indices were utilized in this study to establish if an association existed between compliance and the pre-injury activity level of each subject. The method chosen to investigate this was a questionnaire developed by Baecke et al (1982).

Exercise prescription

Exercises were prescribed and instructed by the consulting physiotherapist ($n = 11$). It was suggested to the consulting physiotherapist that no more than four exercises should be given to each patient where possible. This was determined through consultation with all participating physiotherapists with regard to their normal practice of exercise prescription, and from a research perspective it was deemed necessary to standardize to some extent the effect of treatment complexity and dose effect on exercise compliance (Haynes 1979). The number of consultations, as well as the frequency of the exercise and the dose of the exercise, was determined by the consulting physiotherapist in line with normal practice in order to enhance a therapeutic beneficial outcome to the patient.

All subjects received precise verbal exercise instructions in accordance with the Physi-Soft™ exercise manual and received appropriate guidance until they could perform each exercise correctly, and were aware of the prescribed frequency, repetitions, and precautions pertaining to each exercise. Subjects randomized to the control group received no written reinforcement. Subjects in the study group received a personalized computer generated written and illustrated print-out of each exercise from the Physi-Soft™ exercise based software package (Versal©). The Physi-Soft™ software consists of three modules of information and exercise. These modules are named Spinal, Peripheral and Special and together incorporate a data base in excess of 500 therapeutic exercises edited by a manipulative physiotherapist. Each manual is further divided into chapters pertaining to various sections of the anatomy or specific muscle groups or activities. The software is multi-platformed. Individual or groups of exercises can be selected from the manuals and a customized, printed exercise report obtained.

Study period

The study ran for a period of 14 days after the initial exercise instruction. This time limit was chosen to encapsulate the acute and subacute classified time period of LBP (Frymoyer 1988), to study within the period where the self-limiting nature of LBP was not immediately actioned (Quinet & Hadler 1979), and to meet the aim of studying short-term compliance to exercise.

Compliance Formula

Percentage compliance to the prescribed exercise regimen was measured in this present study by dividing the number of exercises performed by the number of exercises prescribed and multiplying by 100. This gave a compliance rate as a percentage for the total exercise regimen administered. Compliance was calculated using a modified formula (Table 1) devised by Goldsmith (1979).

Data analysis

Results were analysed using the following statistical tests: T-test; ANOVA; χ^2; Pearson's correlation and; Mann–Whitney U test. Multiple comparisons were performed by the Scheffé post-hoc method (Shott 1990). Analysis was performed on a Power Apple Macintosh 7200/75 computer with the SPSS version 6.1 statistical package. Prior to the commencement of the study, an alpha level of 1% ($P < 0.01$) was set as the criterion for the determination of statistically meaningful differences in all statistical tests. This more stringent probability level was selected to account for the subjective self-report measurement of compliance, and multiple testing used in this study.

Statistical analysis was performed with parametric tests. All significant parametric analysis was further tested with the nonparametric Mann–Whitney U test to assess whether minor skewness of the data made a difference to the outcome. The Mann–Whitney U results are only reported if they differ from the parametric analysis.

RESULTS

One hundred subjects were recruited into the study. Two of these withdrew from the study of their own accord at the inception of their participation, and nominated their reluctance to answer personal questions in the Personal Information and Compliance Questionnaire as the reason for doing so. A further two were lost to follow up due to incomplete data return despite a postal and telephone reminder, leaving a total of 96 in the study population.

There were two outliers present in the study population data that were deemed not to be homogenous with the main study group. These were subjects who were considered to be over-compliant when analysed with the compliance formula utilized in this study. These subjects performed more exercises than were prescribed and although it is not clear whether they can be classified as non-compliant, compliant or over-compliant, a statistician was consulted and deemed it necessary to omit them from the final data analysis due to their influence on the standard deviation of each group. The omitted subjects were representatives from both the study and the control group. The subject in the control group recorded a compliance rate of 130.9% and the subject in the study group recorded a rate of 152.3%. Analysis with the inclusion of these two outliers did not alter the significance of any of the tests performed. In total, 94 subjects' data were analysed in this study.

Reported mean percentage compliance to exercise in the control group of this study was 38.1%. Mean compliance in the study group was 77.4%. The mean difference between groups was 39.3%. T-test analysis indicated a significant difference ($P<0.000$) between groups for compliance to the prescribed exercises.

Intervention group baseline characteristics were analysed to investigate any significant differences between the control group and the study with regard to personal, economic, disease, referral, treatment, prescription, and disability characteristics, and to investigate any potential confounding in the analysis. Analysis using t-test (t) and χ^2 statistical analysis showed no statistically significant difference between groups with all variables except expected exercise as treatment (Table 1). Fifty percent of subjects from the control group expected exercise to be prescribed by their physiotherapist for the treatment of their LBP, in comparison to 84.8% in the study group. χ^2 analysis showed a significant difference between groups ($\chi^2_1 = 12.86$, $P<0.000$). Subjects who expected exercise to be part of their treatment regimen for their LBP had a significantly higher compliance rate ($t_{92} = 4.93$, $P<0.000$) than those who did not. Further t-test analysis was undertaken within each group to analyse this confounding on the primary hypothesis. Subsequently, there was no statistically significant difference in compliance between those who expected exercise in the control group ($t_{46} = 1.94$, $P=0.058$) nor the study group ($t_{44} = 2.52$, $P<0.016$).

Table 1. Personal, economic, disease, and referral-treatment characteristics by intervention group

Variable	Control group	Study group	*P* value
Personal characteristics			
Mean (SD) age	37.2 (13.2)	38.1 (12.2)	0.745
Gender (male)	60.4	54.3	0.699
Married	52.1	58.7	0.662
Smoker	44.7	28.3	0.153
Perceived fitness	43.8	58.7	0.152
Economic characteristics			
Income < $36 001	81.4	77.1	0.856
Disease characteristics			
Analgesic administration	64.6	54.3	0.423
Previous LBP	31.3	50.0	0.101
Previous exercises for LBP	46.7	78.3	0.097
Referral-treatment characteristics			
New patient	77.1	71.7	0.721
Private patient	60.4	47.8	0.309
Compensatory patient	37.5	50.0	0.311
Changed exercise program	39.6	30.4	0.476
Expected exercise as treatment	50.0	84.8	0.000*
Confidence in physiotherapist	100	97.8	0.983
Exercise reminder by family	16.7	34.8	0.075
Regular physiotherapist reminder	35.4	39.1	1.000

Unless otherwise stated numbers are percentages (%).
* Significant at better than $P<0.01$ level between groups.

Habitual physical activity

A habitual physical activity questionnaire was administered at completion of the study period and index scores were calculated by the formula described by Baecke et al (1982). There was a significant difference in scores for sport and total indices between treatment groups (Table 2). The mean sport index for the control group was 0.5 compared with 1.7 for the study group. The total index score reflects the contribution of sport to the overall total. There was no significant difference between work and leisure scores and group. Low correlations were recorded when the indices of habitual physical activity and percentage compliance were analysed (Table 3). Sport and total index are shown to have the higher correlations at 0.29 and 0.32 respectively. Confounding of these two variables between groups (Table 2) may be responsible for this result.

DISCUSSION

Measurement of compliance in home-based exercise therapy regimens is a difficult task and objective methods are often impractical, intrusive or expensive. Subjective report of compliance, is at present, the best that can be achieved with home-based therapeutic exercise and has a variable degree of accuracy depending on its implementation. Due to the subjective nature of the compliance data collection in this study, it is emphasized, that the compliance rates analysed are reported data only and therefore still subject to validation.

Reported mean percentage compliance to exercise in the control group of this study was 38.1%. Although there is sparse literature on exercise compliance rates for acute LBP patients, it appears from the medical and chronic LBP literature that the percentage of non-compliance in this study is consistent with the reported one third to two thirds of patients who are found to be non-compliant with therapeutic exercises in general (Sluijs et al 1993). Spelman (1984) reported a 30% compliance rate to exercise therapy in the control group of a cohort of chronic LBP patients and Ferguson & Bole (1979) found that 40% of rheumatoid arthritis patients complied with exercise compared to 78% with Aspirin. Deyo (1982) in a review of the compliance literature on arthritis, reported that compliance with physiotherapy regimes was consistently worse than that with medication and the percentage of patients judged to be compliant ranged from 34 to 62%.

The inclusion of written and illustrated reinforcement supplementary to verbal instruction resulted in a mean compliance rate of 77.4%. Written and illustrated exercise instructions may impact on compliance in a number of different ways. Exercise prescription often involves complex chains of sequenced events, actions and patient behaviour that may be difficult to remember. Written and illustrated exercise instructions may enhance compliance by increasing understanding,

Table 2. Summary table. Habitual Physical Activity Index by Group

Habitual physical activity	Control group	Study group	*P* value
Work index	2.7 (0.9)	2.9 (0.6)	0.301
Sport index	0.5 (1.2)	1.7 (2.0)	0.001*
Leisure index	2.5 (0.5)	2.8 (0.6)	0.032
Total index	5.7 (1.6)	7.3 (2.3)	0.000*
99% confidence interval	5.1–6.3	6.4–8.3	

Numbers are means (SD).
* Significant at better than $P < 0.01$ level.

stimulating memory processes, and enhancing information recall. As a result communication will be better facilitated between patient and physiotherapist. Illustrations may serve two purposes when added to written instructions. Firstly they provide a diagrammatic representation of the written word, enhancing understanding and facilitating correct performance of the exercise prescribed. Secondly, the illustrations may indirectly make the written instructions more attractive and more likely to be read and thus as a consequence, increased compliance to the regimen may be facilitated (Ley 1988).

A basic issue in physiotherapy is whether and when improved compliance will actually alter outcomes. Delineation of the degree of regular or systematic compliance necessary to optimize therapeutic results in LBP is considered to be dose/response dependent although precise details about this relationship are unknown. Unfortunately, there is also considerable uncertainty about the goals and efficacy of many commonly used therapies including exercise (Deyo 1982; Oldridge 1982). The present study design did not permit a valid analysis of treatment outcome with regard to the exercise therapy intervention. Exercise was not the only intervention employed by physiotherapists in this study and therefore a comparable outcome improvement in either group may be interpreted not to have occurred exclusively from the exercise component of management. Manipulation in particular has been shown beneficial in the treatment of non-specific LBP (DiFabio 1992). It is therefore impossible to make inferences to the efficacy of exercise therapy in this study. In cases where exercise is the sole intervention, compliance may be seen to take on more importance.

Established exercise habits have previously been identified as predictor variables of compliance. An inactive lifestyle, often characterized by a low energy demand job and sedentary leisure pursuits, has been associated with exercise noncompliance (Oldridge 1982). In this study, habitual physical activity was calculated into four indices: leisure, sport, work and the sum of these, total-activity (Baecke et al 1982). Inspection of Table 2 indicates that there is a significant difference between groups for the indices sport ($P = 0.001$) and total-activity ($P < 0.000$) but not for work or leisure indices. This would appear to have low clinical significance as there was low correlation between percentage compliance and the indices of leisure, work, sport, and total-activity across both treatment groups (Table 3). This finding is similar to Tooth et al (1993), who noted that previous weekly exercise MET (basal metabolic equivalent) hours of activity yielded insignificant results when analysed in an attempt to predict compliance with a post-myocardial infarction home based exercise program.

Subjects who expected exercise to be part of their treatment regimen for their low back pain had a significantly higher compliance rate than those that did not and were also represented significantly more in the study group than the control (Table 1). Expectation would seem to have a positive effect on compliance for a number of reasons. Primarily, it may be seen to act as a motivational or predisposing factor for a health behavior (Green 1979). Motivation, which is primarily concerned with activation and persistence of behaviour, is seen to be cognitively based and through cognitive representation of future outcomes, individuals can generate current motivators of behaviour. Cognitive processes play a prominent role in the acquisition and retention of new behaviour patterns such as the instigation of an exercise regimen. It should be noted, however, that the questionnaire containing this variable was administered following completion of the exercise component of the study. Subjects at this stage would be able to calculate an accurate indication of their compliance behaviour during the study. Subjects who reported expecting exercise prescription, may be doing so to qualify or justify their compliance to the regimen, and subjects whose compliance was low may report that the exercise prescription was unexpected, as a reason or excuse for their noncompliance. Exercise expectation as a determinant of compliance to exercise therapy in this study may therefore lack specific validity because the question pertaining to it was administered retrospectively.

CONCLUSION

The incorporation of written and illustrated exercise instructions as an educational strategy to improve compliance to exercise therapy for LBP is clearly shown to be effective in this study. Verbal instruction alone, facilitated low levels of compliance that may not be efficacious in bringing about desired results to active participation in some outcome-specific exercise regimens. Further research into the efficacy of specific,

Table 3. Pearson's correlation coefficient of association between percentage compliance and habitual physical activity

Habitual physical activity	r	*P* value
Work	0.086	0.412
Sport	0.289	0.005
Leisure	0.218	0.035
Total	0.322	0.002

tailored exercise is needed to justify the continuing inclusion of exercise in the management of acute LBP. It is suggested that exercise is prescribed with accompanying written and illustrated instructions to increase compliance in prospective clinically randomized trials of therapeutic exercise.

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