Arthritis & Rheumatism (Arthritis Care & Research)
Vol. 55, No. 4, August 15, 2006, pp 662–664
DOI 10.1002/art.22086

CONTRIBUTION FROM THE FIELD

Do Training Diaries Affect and Reflect Adherence to Home Programs?

G. LORIMER MOSELEY

Introduction

Adherence is the degree to which patients and research participants act in accordance with the advice of their clinician or researcher (1). Adherence is an important issue in the practice of health care. Incomplete adherence is widely regarded as a substantial barrier to successful outcomes (i.e., exercises don't work if you don't do them). It has been proposed that ~5.5% of hospital admissions (~2 million per year in the US) (2), and ~1.7% of the national health care bill (3) can be attributed to poor adherence. It is not surprising then, that numerous studies have investigated ways to increase adherence (4). Many studies examine adherence to medication regimen (5,6) but adherence to exercise and home training programs, which form an important part of the management of many chronic conditions including cardiovascular disease (7) and rheumatic disease (8), is equally important.

Adherence is also important in research practice. In addition to interfering with the completion of research studies, reducing statistical power, and inflating the cost of research studies, poor adherence undermines the very treatment under investigation, which increases the risk of erroneous conclusions and false rejection of effective treatments. Therefore for the researcher, equal attention must be given to maximizing and measuring adherence.

One common method to evaluate and promote adherence with home programs is a training diary (4). Despite their widespread clinical and research use, it is not known how the use of a training diary affects or reflects adherence. These issues form the basis of the current study, which hypothesized that patients overestimate adherence to a home program in their training diary; using a training diary increases adherence; and overt monitoring increases adherence.

G. Lorimer Moseley, PhD: Oxford University, Oxford, United Kingdom, and The University of Sydney, Sydney, Australia.

Address correspondence to G. Lorimer Moseley, PhD, Department of Physiology, Anatomy, and Genetics, University of Oxford, South Parks Road, Oxford OX1 3QX, United Kingdom. E-mail: lorimer.moseley@ndm.ox.ac.uk.

Submitted for publication August 2, 2005; accepted in revised form January 26, 2006.

Patients and Methods

The study group comprised 67 patients (32 women) referred to the study from the hospital physiotherapy department, local physiotherapy practices, or general medical practices. The patients had received a diagnosis of complex regional pain syndrome type 1 of one limb from their treating practitioner, and were currently not working. The mean ± SD age of the patients was 32 ± 10 years, height was 166 ± 18 cm, and weight was 69 ± 15 kg. This population was suitable because the authors had previously been exploring home exercise programs that used a computer-based task. Patients were told that the study involved evaluation of a new software-based training program. Each patient gave informed consent, and all procedures were approved by the institutional ethics committee. The patients were assessed for signs and symptoms of complex regional pain syndrome type 1, and 14 patients who did not fulfill the established criteria (9) were excluded. A neuropathic pain questionnaire (10) was completed by each patient, and finger circumference was measured by an independent investigator.

All patients participated in a computer-based graded motor imagery home exercise program to reduce pain and disability (11). The program consisted of 3 phases: limb laterality recognition, imagined movements, and mirror movements, with each phase lasting 2 weeks. The first 2 phases included a home training program in which patients were instructed to perform a computer-based task once every waking hour from 9:00 AM to 9:00 PM, using a notebook computer that was supplied for the first 2 stages of the program. Familiarity with computers was not formally evaluated, but each patient was taught how to start the computer and use the program. The task is described in detail elsewhere (11,12) and consists of an in-house software program that records the time and duration of each performance. A training diary, completion of which consisted of the patient recording the time at which they performed the task, was also used to record the time of each performance. The number of times the task was performed between 9:00 AM and 9:00 PM each day, expressed as a proportion of the total possible (13/day), was used for analysis.

Using a random numbers table, each patient was assigned to either a group that completed the training diary

during the first phase or to one that completed the diary during the second phase of the program, and to either a group that was told that the software program was recording adherence (overt monitoring) or to a group that was told it was not recording adherence (covert monitoring). Twenty-seven patients (14 women) completed the training diary during the first stage, 26 patients (18 women) completed the diary during the second stage, 25 patients (11 women) were allocated to the overt monitoring group, and 28 patients (14 women) to the covert monitoring group. At the completion of data collection, patients were individually debriefed and the true purpose of the study was explained. If they were part of the covert monitoring group, it was emphasized that subjects were randomly allocated, and that all data had patient identifiers removed so that data could not be linked to a particular subject.

All data were entered into an electronic file by an independent investigator blinded to the allocation groups. Statistical analyses were conducted using SPSS Software, version 11.0 (SPSS, Chicago, IL). The hypotheses (using a training diary and covert monitoring increase adherence) were tested using a 1 (adherence) × 2 (use of a training diary, monitoring method) analysis of covariance (ANCOVA), with the age, sex, duration of symptoms, and training diary phase being entered as covariates. To investigate whether patients overestimated adherence in their training diary, and to test the effect of covert monitoring on the accuracy of training diaries, a 1 (difference between computer-recorded data and training diary data) × 1 (monitoring method) ANCOVA was used, with training diary record, age, sex, and duration of symptoms used as covariates. Statistical significance was set at $\alpha = 0.05$.

Results

One patient in the overt monitoring group and one in the covert monitoring group dropped out and their data were not analyzed. Mean ± SD adherence of the remaining 51 patients was 77 ± 11. The first ANCOVA investigating the effect of monitoring method and the use of a training diary on adherence was significant ($F[7,192] = 4.28$, $P < 0.001$). There was a main effect of monitoring method ($F[1,192] = 3.09$, $P = 0.045$) and of the use of a training diary ($F[1,192] = 2.99$, $P = 0.049$). Overt monitoring increased adherence by ~7%, and the use of a training diary increased adherence by ~8% (Figure 1). There was an interaction between monitoring method and the use of a training diary ($F[1,192] = 14.39$, $P < 0.001$). Adherence was greatest in patients who knew they were being monitored (covert group) and who were using a training diary (mean, 95% confidence interval [95% CI] 89.05, 84.10–93.96), and adherence was lowest in patients who did not know they were being monitored (overt group) and were not using a training diary (mean, 95% CI 68.46, 57.92–78.12) (Figure 1A). Sex, age, and duration of symptoms did not significantly affect adherence ($P > 0.09$ for all).

The second ANCOVA investigating the effect of monitoring method on the accuracy of training diaries was also significant ($F[5,44] = 25.20$, $P < 0.001$). Patients who knew that the computer was recording adherence underestimated their adherence in their training diary by ~5% (95% CI 0.51–9.48), but those who did not know they were being monitored overestimated adherence by ~10% (95% CI 3.0–16.9) (Figure 1B). There was also a correlation between the duration of symptoms and the accuracy of training diaries ($F[1,44] = 5.89$, $P = 0.19$), in that patients with longer duration of symptoms had more inaccurate training diaries.

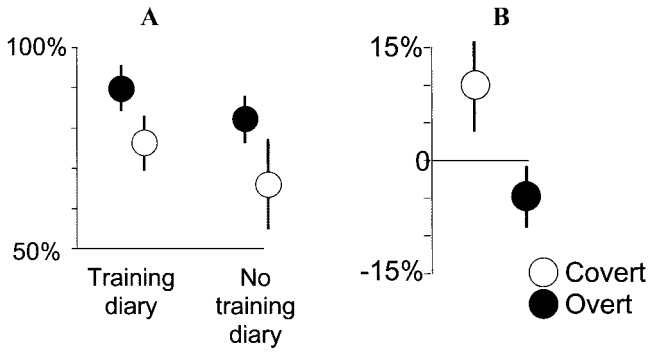

Figure 1. **A**, Adherence to the home exercise program when patients were using a training diary and when they were not. Data for patients who knew the computer was recording their participation (overt monitoring) and those who did not (covert monitoring) are shown. **B,** Accuracy of the training diary for patients who knew the computer was recording their participation (overt monitoring) and those who did not (covert monitoring). Accuracy <0 reflects an underestimation and >0 reflects an overestimation of true adherence recorded by the computer.

Discussion

The results support the hypothesis that patients completing a training diary for a home program tend to overestimate their program adherence. According to these data, the overestimation is ~10% and is seldom <3% or >17%. The relatively small variance of the differential between reported and actual participation suggests that a training diary is probably a useful mechanism by which to estimate adherence, albeit while allowing for the overestimation. The results also support the hypothesis that using a training diary increases adherence with a home program. The magnitude of that effect is ~8%, or, in the current study, 1 performance of the task per day. An 8% increase in adherence may be of limited clinical importance, but in home programs that are less intense than the program used here, one performance of the task per day may represent a large proportion of the overall program. Further work is required to determine the applicability of this finding to other less intense home programs. An effect of ~7% was also exerted by overt monitoring, which implies that it is preferable where possible (i.e., in the case of computer-based exercises or medication regimen) to advise patients that their participation is being monitored.

One other result is intriguing: that the longer patients have had complex regional pain syndrome type 1, the less accurate their training diary becomes. The fact that underestimation increases during covert monitoring may suggest that patients with a longer disease duration are less involved in their rehabilitation and adopt a lackadaisical approach. The finding that overestimation increased during overt monitoring supports that hypothesis, and may

also reflect the patients' declining belief in the worth of the home program or expectation of a positive response. It is possible that longer duration of symptoms also reduces adherence, regardless of monitoring or the use of a training diary and that the current study was underpowered to detect this effect. This possibility is based on the result that such an effect neared significance ($P = 0.09$), and could possibly be confirmed through future studies.

One encouraging aspect of the current results is that adherence was ~78% in patients who were issued a training diary and did not know the computer was recording their participation. That group was the most clinically relevant and their compliance compares favorably with available data. For example, adherence with medication regimens is reported to be in the range of 35–50% (13), and adherence to exercise programs is thought to be worse (14). Obviously, adherence in a research project is likely to be greater than that during the normal course of treatment.

This study had a small, but relatively homogenous sample, which limits its power and generalizability; perhaps these findings apply specifically to patients with complex regional pain syndrome type 1. The study did not control for issues such as when patients began their day, or whether or not they were able to take the notebook computer with them if they left home. To control for those issues would both increase the methodologic sensitivity of the protocol and decrease the relevance of the findings to real clinical situations. Because this study detected effects without controlling for those issues, they probably do not compromise the main findings.

In summary, patients overestimate their adherence to home programs, but the use of a training diary and overtly monitoring performance appear to increase adherence. The accuracy of a training diary seems to decrease in relation to the duration of symptoms, which suggests that training diaries become less valuable as the duration of symptoms increases.

REFERENCES

1. Haynes R. Introduction. In: Haynes R, Taylor D, Sackett D, editors. Compliance in health care. Baltimore: Johns Hopkins University Press; 1979. p. 1–7.
2. Sullivan S, Kreling D, Hazlet T. Noncompliance with medication regimens and subsequent hospitalizations: a literature analysis and cost of hospitalization estimate. J Res Pharm Econ 1990;2:19–33.
3. Robiner WN. Enhancing adherence in clinical research. Contempo Clin Trials 2005;26:59–77.
4. Roter DL, Hall JA, Merisca R, Nordstrom B, Cretin D, Svarstad B. Effectiveness of interventions to improve patient compliance: a meta-analysis. Med Care 1998;36:1138–61.
5. Dobbels F, van Damme-Lombaert R, Vanhaecke J, de Geest S. Growing pains: non-adherence with the immunosuppressive regimen in adolescent transplant recipients. Pediatr Transplant 2005;9:381–90.
6. Contreras EM, Garcia OV, Claros NM, Guillen VG, von Wichmann MD, Martinez JJC, et al. Efficacy of telephone and mail intervention in patient compliance with antihypertensive drugs in hypertension. ETECUM-HTA study. Blood Pressure 2005;14:151–8.
7. Wright SP, Walsh H, Ingley KM, Muncaster SA, Gamble GD, Pearl A, et al. Uptake of self-management strategies in a heart failure management programme. Euro J Heart Fail 2003;5: 371–80.
8. McQuay HJ, Moore RA, Eccleston C, Morley S, Williams AC. Systematic review of outpatient services for chronic pain control. Health Technol Assess 1997;1:i–iv, 1–135.
9. Bruehl S, Harden RN, Galer BS, Saltz S, Bertram M, Backonja M, et al, and the International Association for the Study of Pain. External validation of IASP diagnostic criteria for complex regional pain syndrome and proposed research diagnostic criteria. Pain 1999;81:147–54.
10. Backonja M, Krause S. Development of a neuropathic pain questionnaire. Clin J Pain 2003;19:306–14.
11. Moseley GL. Graded motor imagery is effective for long-standing complex regional pain syndrome. Pain 2004;108:192–8.
12. Moseley GL. Is successful rehabilitation of complex regional pain syndrome due to sustained attention to the affected limb? A randomised clinical trial. Pain 2005;114:54–61.
13. Dunbar-Jacob J, Erlen J, Schlenk E, Ryan C, Sereik S, Doswell W. Adherence in chronic disease. Ann Rev Nurs Res 2000;18: 49–90.
14. Meichenbaum D, Turk DC. Facilitating treatment adherence: a practitioner's guidebook. New York (NY): Plenum Press; 1987.